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AN INQUIRY INTO THE RELATIONSHIP BETWEEN THE QUALITY AND KIND OF MATRICULATION PASSES OF MEDICAL STUDENTS AND THEIR SUBSEQUENT SUCCESS OR FAILURE IN THE VARIOUS ANNUAL EXAMINATIONS.

By F. S. COTTON, D.Sc.,
Chief Lecturer in Physiology, the University of Sydney.

Object of the Investigation.

THE object of the investigation was to discover to what extent failure in the annual medical examinations at the University of Sydney was associated with specific types or qualities of matriculation pass (leaving certificate or March matriculation examination). To this end a list was made of all students in the medical course in 1937, divided into the various years. Blank forms were then prepared, so that the complete pass of each student could be fully set out. The majority of these forms were filled in by the students themselves. This was done by distributing the forms during lecture periods or in practical classes. The rest were filled in by the office staff from the data on their files. The first year has been omitted from the analysis since it is obvious that students commence this course with very varying degrees of advantage and disadvantage. The fifth year data were also omitted, since the number of failures (less than ten) was too small to be useful and out of proportion to the numbers in the other years. The bulk of the analysis was made with reference to the mid-medical years, second, third and fourth. This was commenced as soon as the second and third year data were available. When the fourth year data came to hand the analysis was recommenced to incorporate this, and as some 370 students were here concerned it was felt that this was sufficient

for statistical significance. Finally, the sixth year data were ready. This was used for some additional analyses, but could not be amalgamated with the rest without a considerable amount of work being repeated. In the case of each significant result, however, a cursory survey was made on the sixth-year data, sufficient to demonstrate agreement with the data of the mid-medical years. We may therefore conclude that the results quoted for the group of some 370 odd students are sufficiently representative for medical students in general. If minor differences do exist between the types of students who are more successful in one medical year than in another, they could be established only by examination of the pooled results of several instances of those particular years.

Section I: Relation of the Quality of Matriculation Pass to Success or Failure in the Annual Medical Examinations.

The first type of general analysis was made on the following lines:

The full group of students was divided into two sub-groups: (i) those having a certain type of matriculation pass, (ii) the rest. Let these be called S_1 and S_2 respectively. S_1 and S_2 were then separately examined in regard to subsequent success or failure in the annual examinations in medicine. The following results were computed:

1. The sizes of the subgroups S_1 and S_2 as percentages of the whole group.
2. The percentage of the total number of failures (F) found in S_1 and S_2 respectively.
3. The percentage of the total number of passes (P) found in S_1 and S_2 respectively.
4. The actual failure rates expressed as percentages in each of S_1 and S_2.
5. The ratio of P to F in each of S_1 and S_2.

In the analyses P means passed the December examination, 1937, F means failed in either March or December, 1937. In this way students repeating the year are classified with the "failure" and not with the "pass" group. The success of the whole investigation largely depends on this point.

In order to make various trial subdivisions into S_1 and S_2 it was first of all necessary to assess the pass of each candidate on a numerical basis. This was done by assigning a numerical value of so many points to each grade of pass in each subject (see Table I). By this method the minimum pass

TABLE I.

The Method of Allotment of Points according to the Standard of Pass at Matriculation.

Grade.	Points.
Honours I	9
Honours II	8
A	7
B	6
Lower standard	5

(*B*, *B*, *B*, *L*) would be rated as 23 points ($3 \times 6 + 5$) and the maximum pass (*H*1, *H*1, *H*1, *H*1, *A*, *A*) would be rated as 78 ($4 \times 9 + 6 \times 7 = 36 + 42 = 78$), since each honour necessitates a preliminary pass in a separate paper at the *A* standard. This follows the procedure of grading students for exhibitions *et cetera* by taking the aggregate marks for all papers up to ten.

A number of trial subdivisions were essayed and the various calculations made as indicated above. Of these, some five subdivisions are analysed in Table II. In this table it will be noted that there occurs throughout a marked superiority of the ratio P/F in favour of S_2; that is, r_2 is always much

TABLE II.

Relation of Success or Failure at Examinations in Medicine to Standard of Pass at Matriculation.

—	I. When S_2 = One *A*, or More, at Leaving Certificate Examination.		II. When S_2 = at Least One *A*, or More than 37 Points at Leaving Certificate Examination.		III. When S_2 = at Least One *A*, or More than 35 Points at Leaving Certificate Examination.		IV. When S_2 = More than 35 Points at Leaving Certificate Examination.		V. When S_2 = One *A*, or More, *plus* Science, at Leaving Certificate Examination.	
	S_1.	S_2.	S_1.	S_2.	S_1.	S_2.	S_1.	S_2.	S_1.	S_2.
S_1 and S_2 as percentages of all students concerned	41	59	34	66	29	71	32	68	49	51
Failures in S_1 and S_2 as percentages of all failures	62	38	58	42	53	47	58	42	73	27
Passes in S_1 and S_2 as percentages of all passes	31	69	22	78	18	82	22	78	37	63
Failure rate	50	22	56	21	61	22	56	20	50	17
Ratio of passes to failures (r_1 or r_2)	1·0 ($=r_1$)	3·5 ($=r_2$)	0·80 ($=r_1$)	3·9 ($=r_2$)	0·65 ($=r_1$)	3·5 ($=r_2$)	0·80 ($=r_1$)	4·0 ($=r_2$)	1·0 ($=r_1$)	4·6 ($=r_2$)
Index of segregation ($R = r_2/r_1$)	3·5		4·9		5·4		5·0		4·6	

NOTE.—"Pass" means a pass at the December examination, 1937; "failure" means failure at either March or December examination, 1937; S_1 means those who reached a poor standard only at matriculation; S_2 means those who reached a higher standard at matriculation than the S_1 group.

greater than r_1. This degree of superiority in any trial subdivision may be measured by the ratio of r_2 to r_1, which is here designated R and termed the index of segregation, as it is a measure of the degree to which the better class of student is segregated from the weaker class.

It will be seen that in Subdivision III we have the highest index of segregation. This index is greater for Subdivision III than Subdivision IV, since in an investigation of S_1 of the latter a small group were found having a good P/F ratio. These were the students who had reached the A standard in any one subject. On transferring this small group from S_1 to S_2 of Subdivision IV we derive Subdivision III, which must therefore give a better index of segregation. The various proportions and ratios of Subdivision III are illustrated in Figure I, which shows the main facts at a glance. It should

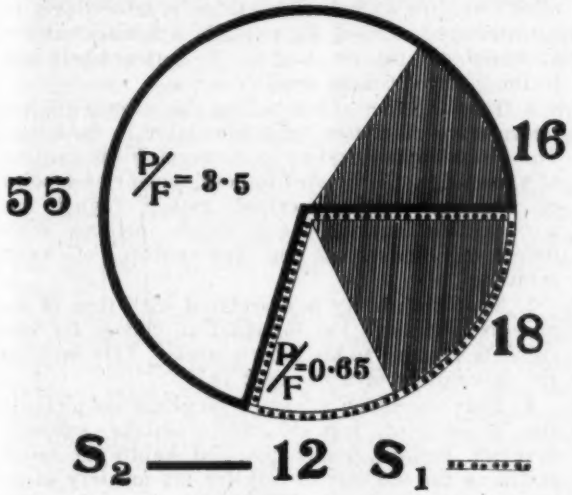

FIGURE I.

Showing graphically the various proportions of Subdivision III of Table I. (The clear area indicates "pass", the shaded area "failure".)

be noted that the various percentages do not add up to 100 but to 101. This is merely because each is given to the nearest whole number, for convenience. It will be seen that although the S_1 group is relatively small (29% of all) it contains more than half the failures in medicine; this would imply that if the matriculation standard were raised to the extent indicated, approximately 30% of the candidates would be eliminated and with them more than half the future failures, and, further, in all probability the poorer half.

Section II: Relation of the Type of Subjects Taken at Matriculation to Success or Failure in the Annual Medical Examinations.

The object of the analysis was to divide the candidates into two subgroups, S_1 and S_2, according to some specific criteria concerning the type of subjects taken, in order to determine whether the P/F ratio was significantly different in these subgroups.

In the first place it was decided to attempt a subdivision into S_1 (those whose passes had a bias toward the language and history subjects) and S_2 (those whose passes had a bias toward the mathematical and science subjects). For convenience S_1 will be called the *L.H.* group and S_2 the *M.S.* group. Most candidates were found to be readily classified into these subgroups. In some cases, however, the subjects were evenly divided between *L.H.* and *M.S.* types. In these cases the classifications were determined by the quality of pass in the different subjects; for example, if the candidate obtained *A, B, B* in three of the *L.H.* subjects respectively and *B, B, B* in the *M.S.* subjects he was grouped as *L.H.* Proceeding in this way all except some seventeen subjects could be classified as *L.H.* or

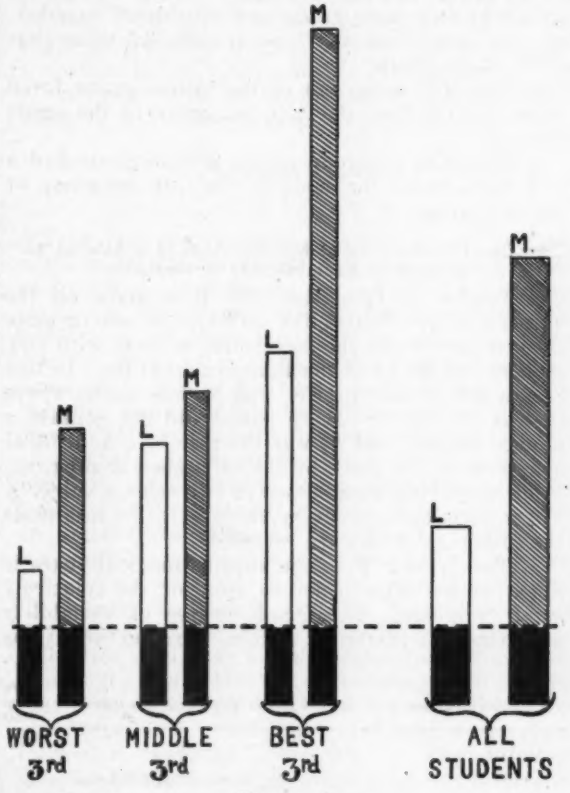

FIGURE II.

Showing the relative degree of success in the yearly examinations of medical students according to whether their university entrance passes showed a bias toward literary or mathematical and scientific subjects. *L* = literary trend, *M* = mathematical and scientific trend. The black areas indicate failure; the shaded and clear areas indicate pass. The worst, middle and best thirds refer to classification by quality of matriculation pass. The ratio P/F in each subgroup of the three subdivisions is shown by the ratio of the rectangle above the dotted line to that below it, the latter being kept at constant height throughout to facilitate comparison.

M.S. This residue was omitted from the analysis. In order to make a more detailed comparison of the success or failure of the *L.H.* and *M.S.* subgroups the whole group was divided into three grades in accordance with the previous allocation of points:

1. The best third, namely, those scoring between 45 and 78 points, inclusive.

2. The middle third, namely, those scoring 36 to 44 points, inclusive.

3. The lower third, namely, those scoring between 23 and 35 points, inclusive.

Within each of these divisions the subgroups *L.H.* and *M.S.* were made, and in each of the six subgroups so obtained the ratio *P/F* was computed in the case of the annual medical examinations. The results are shown in graphical form in Figure II. On examination, Figure II shows the following facts:

1. The *M.S.* subgroup in each of the three grades was much superior in the yearly examinations to the *L.H.* subgroup; this being specially pronounced in the lowest and highest grades.

2. When all three grades are considered together, the *M.S.* group had a *P/F* ratio about 3·5 times that of the *L.H.* group.

3. The *M.S.* subgroup of the lowest grade fared rather better than the *L.H.* subgroup of the grade above it.

4. The *M.S.* subgroup of the middle grade had a *P/F* ratio much the same as the *L.H.* subgroup of the first grade.

Section III: Relation of Matriculation in a Science to Success in Examinations in Medicine.

A further investigation was then made on the question of correlating the inclusion of one or more science subjects in the matriculation pass with subsequent success in the medical examinations. In this case a subdivision into S_1 and S_2 was made, where S_1 was that group whose passes did not contain a science subject, and S_2 was the rest. An additional comparison was made by taking a special subgroup S_3 of candidates who passed in two science subjects. The results are set out in Table III. In this table the following points are revealed:

1. The ratio *P/F* in the various medical years is much of the same order in spite of the relatively small numbers. This small degree of variability is distinctly a matter of chance. Greater variations than this would probably occur in further similar analyses. However, the mean ratios for S_1 and S_2 are probably fairly stable, so that the comparison of 3·2 to 0·79 is reasonably reliable. The marked superiority of group S_3 is a matter of considerable surprise. The progressive improvement in the *P/F* ratio from second year to fourth *plus* sixth years seems definite enough in spite of the fact that the subjects of physics and chemistry might be expected to exercise a dwindling influence during a student's progress through medicine.

Discussion.

A number of ideas have occurred to the writer in relation to the foregoing and several have been suggested by others. The chief of these may be enumerated below.

1. That the student who possesses the type of mind likely to do well in medicine is more likely to be interested in choosing to study a science subject at school, and this (*a*) may or (*b*) may not help him in the medical course itself.

2. That the fact of his taking the science subject irrespective of choice helps him later in medicine. This might operate: (*a*) by increasing his content of knowledge, (*b*) by steady development of a point of view generally described rather vaguely as a "scientific outlook", but which includes some developing judgement on the nature of valid evidence.

3. That his ability is correlated with that of his parents who have the foresight to choose for him subjects of value to his future career. This involves the assumption of 2 (*a*) or 2 (*b*).

4. That overmuch study of language subjects, to the neglect of logical and scientific subjects, develops certain tendencies and habits of mind, inclining the student to rely for his mastery of an examination subject more upon sheer memory and adherence to rules than upon logical reasoning and the consideration of evidence.

TABLE III.

The Relative Successes in the Medical Course of Students who Passed in One or More Sciences at Matriculation and Students who did not Pass in a Science at Matriculation.

	S_1. No Science at Matriculation.			S_2. One Science or More at Matriculation.			S_3. Two Sciences at Matriculation.		
	Number of Passes (*P*).	Number of Failures (*F*).	Ratio of Passes to Failures (*P/F*).	Number of Passes (*P*).	Number of Failures (*F*).	Ratio of Passes to Failures (*P/F*).	Number of Passes (*P*).	Number of Failures (*F*).	Ratio of Passes to Failures (*P/F*).
Medicine II	25	32	0·78	85	25	3·7	35	8	4·4
Medicine III	14	19	0·74	68	20	3·4	26	4	6·5
Medicine IV	12	15	0·80	41	18	2·3	14	1	Large
Medicine VI	12	14	0·86	51	15	3·4	16	0	Large
Total or mean	63	80	0·79	245	76	3·2	91	13	7·0

NOTE.—"Pass" means a pass at the December examination, 1937; "failure" means failure at either March or December examination, 1937.

5. That students who commence the study of physics and chemistry for the first time on taking up the medical course have so much detail to learn in their first year that they have insufficient time for leisurely reflection and meditation of their subject, which are so necessary in weaving a fabric of correlated knowledge. Further, that this lack may be made good in later years only in the case of those students who have a sufficient margin of mental calibre over the average.

The writer is inclined to think that several factors play a part in the whole matter, the chief being 1 (*a*), 2 (*b*), 4 in the case of weak students, but very little or not at all in the case of bright students, and 5 also for all students to some extent, but for weak students to a much greater extent.

Summary.

Evidence is advanced to show the following:

1. That the matriculation passes of medical students is distinctly correlated with the results of subsequent yearly examinations.

2. That approximately the weaker 30% by matriculation standards are responsible for more subsequent failures than the better 70%.

3. That students who have passed in a science subject at matriculation have much more success in the medical examinations than those who have not done so. The pass-to-fail ratio is rather greater than 3.

4. That, of those students who have not passed in a science subject at the matriculation examination, distinctly more fail than pass in the annual medical examinations, in spite of the fact that the group contains numerous bright students who have no difficulty with the medical course. The pass-to-fail ratio of these is approximately 0·8.

CLAW-FOOT.[1]

By NORMAN LITTLE, M.B., Ch.M. (Sydney), M.Ch.Orth. (Liverpool),

Honorary Assistant Orthopædic Surgeon to the Out-Patients' Department, Lewisham Hospital, Sydney.

THERE is still some confusion of the terms claw-foot and *pes cavus*; so first of all I shall define what is accepted as a claw-foot. A claw-foot is one in which clawing of the toes, a cavus deformity of the foot itself and a tight *tendo Achillis*, not necessarily a contracted one, are present. Even this definition does not cover all stages of the deformity, but it is sufficient for the great majority of cases.

ÆTIOLOGY.

There are many causes of claw-foot, which can be classified under the following headings.

[1] Read at a meeting of the Orthopædic Section of the New South Wales Branch of the British Medical Association on September 23, 1937.

Congenital Causes.

Congenital claw-foot is associated with *spina bifida* or some myelodysplasia. The patients belonging to this group do not as a rule develop the deformity until they reach the age of five or six years. There may be evidence of paralysis or paresis of certain muscle groups, especially of the intrinsic muscles of the foot, but the action of these is somewhat difficult to demonstrate in children. The deformity, which may be either unilateral or bilateral, may not, however, appear until adolescence. Once it has appeared, however, it invariably progresses unless proper treatment, after-care and supervision are instituted. In some cases in which these congenital anomalies are present there are clinical manifestations in the shape of trouble with micturition and sensory disturbances in the lower limbs. The claw-foot which accompanies *spina bifida occulta* can be reasonably assumed to be of neurological origin.

Acquired Causes.

Infantile Paralysis.

True claw-foot is most frequently seen in those cases in which the extent of paresis is negligible, or in the so-called sound leg. Paralytic calcaneo-cavus and its modifications do not come under the heading of claw-foot, but a typical example is frequently seen when the only apparent residual paralysis is that of the *tibialis anticus* muscle. On the other hand, the *tibialis anticus* may be the only muscle involved, and the foot may show no evidence of clawing. In the former case careful investigation will reveal paresis of the *extensor digitorum longus* and the *extensor hallucis longus*, as well as an inability to move the toes freely. This latter combination, a weakness of all the extensor muscles, is the main cause of claw-foot, according to Todd. He is very concerned to show that there is no shortening of the *tendo Achillis* and that the deformity is entirely due to a falling of the anterior part of the foot, whereby the tendons of the muscles controlling the toes work at a mechanical disadvantage with consequent clawing of the toes. Duchenne regarded paralysis of the intrinsic muscles of the foot with overaction and later contracture of the long flexors and extensors as the underlying cause. Todd objected to this theory because, as he stated, no one had demonstrated atrophy or other changes associated with infantile paralysis in these small muscles. That may be so; but not many surgeons would surgically investigate the front of the foot to determine the state of the interossei and lumbricals.

It is probable that both theories are correct, and that by the time the deformity is seen it is well established, with recovery in most of the muscles primarily involved. Contractures in the peri-articular tissues round the metatarsophalangeal and interphalangeal joints of the toes prevent the interossei and lumbricals from acting and the clawing remains. On these assumptions it would be

anticipated that paralytic claw-foot would reach a certain stage and then remain stationary; and that is exactly what it does.

Progressive Lesions of the Central Nervous System.

In diseases such as Friedreich's ataxia, the peroneal type of muscular dystrophy, pseudo-hypertrophic muscular dystrophy and other similar conditions, claw-foot is frequently encountered. These ætiological factors must be kept in mind and ruled out in every case of claw-foot occurring without any apparent cause.

In Friedreich's ataxia the gait, absent knee-jerks and a plantar reflex extensor in type should be sufficient for a diagnosis. The peroneal type of muscular dystrophy will cause disturbances of sensation over the outer side of the dorsum of the foot and the outer aspect of the leg in many cases, while the combination of an early claw-foot and claw-hand is very suggestive. The initial deformity of the foot is necessarily an equino-varus deformity, but clawing soon supervenes. Pseudo-hypertrophic muscular dystrophy is relatively common. The combination of a tight *tendo Achillis*, enlarged, firm calves and the procedure adopted by the patient when arising from the lying position will allow the surgeon to fit this disease into its correct category.

Inflammatory Conditions.

A typical claw-foot is occasionally seen as a result of inflammatory contracture of the different components of the sole of the foot.

Vascular Lesions.

The most spectacular type of claw-foot in the category of vascular lesions is that which accompanies so-called trench feet. The pathology appears to be an ischæmia of the small muscles of the feet with secondary contractures in the structures on the plantar aspect.

Idiopathic Claw-Foot.

Under the heading of idiopathic claw-foot are grouped all those cases which we cannot ascribe to any particular cause. The term is applied to that type of deformity which is seen in older children and adolescents, who give no evidence of a previous attack of infantile paralysis or of any lesions of the central nervous system. The lesion is invariably progressive, and may affect one or both feet. The wearing of shoes that are too short or too tight has been blamed as the cause on mechanical grounds. If this were entirely correct, surely claw-foot would be very much more common than it is. Improper shoes may be an aggravating factor, but I think we must look further afield for the primary cause. Perhaps as our knowledge increases more of these cases will be grouped under the heading of congenital causes.

MECHANISM AND PATHOLOGY.

To explain all phases of claw-foot it is necessary to examine the two main theories of causation. Although I have already referred to them, I will repeat them. Duchenne, in 1863, stated that the underlying cause of claw-foot was paralysis or paresis of the interossei and lumbricals, especially in those cases associated with an old infantile paralysis. A few years ago Todd came forward with the theory that paralysis or paresis of the extensor muscles of the foot was the main cause, and that the clawing of the toes was purely mechanical and secondary to the extensor weakness. A careful analysis of a typical claw-foot that comes under the heading of idiopathic claw-foot will convince observers that they are both right. At first there is an extensor weakness with a falling of the forefoot and a tightening of the *tendo Achillis*. The latter is present in a true claw-foot in spite of Todd's assertion to the contrary; its presence is only to be expected. The next stage, in which there is a clawing of the big toe, that is, extension at the metatarsophalangeal joint with flexion at the interphalangeal joint, along with only very slight clawing of the other toes, can occur only with functional insufficiency of the intrinsic muscles of the foot. There are two conditions that help us in an analysis of the mechanism of the claw-foot; one is a paralysis of the *tibialis anticus* muscle alone, as in a congenital absence of the muscle, and the other is a complete lesion of the posterior tibial nerve. In the former there is a dropping of the forefoot and a tightening of the *tendo Achillis*, but not a claw-foot. In the latter there develops a clawing of the toes with a cavus deformity of the foot; but there is no tightening of the *tendo Achillis*, nor is the degree of falling of the forefoot as marked as in a true claw-foot. If the deformity is neglected in this condition the cavus is associated with a contracture of the plantar fascia; but at all stages the pronounced atrophy of the muscles of the sole is the outstanding feature.

So far I have mentioned the first two stages of the deformity. In the second, besides the clawing of the big toe and slight clawing of the others, there is a noticeable cavus deformity of the foot as well as tightening of the *tendo Achillis*. At this stage the great toe can be straightened by pushing upwards on the under-surface of the head of the first metatarsal, but there is some contracture of the plantar fascia and the cavus cannot be entirely obliterated by either active or passive force.

In the third stage all elements of the deformity are more pronounced and structural in character. The cavus deformity is associated with contracture of the plantar fascia and other structures of the sole. All the toes are obviously clawed and exhibit a certain amount of rigidity in the position of deformity. The plantar surface of the forefoot is very convex antero-posteriorly and laterally; in other words, there is a complete collapse of the anterior arch. Callosities are generally obvious on this part of the foot, as most of the body weight is taken here. The degree of tightness of the *tendo Achillis* is difficult to estimate, because of the falling of the forefoot. This stage is undoubtedly due to a combination of functional insufficiency of the interossei and lumbricals and extensor weakness.

Once the intrinsic muscles are unable to place and hold the toes in the optimum position for propulsion by means of the long flexor muscle of the toes, the latter attempts to replace them or can act unhampered, with the result that the toes become flexed at the interphalangeal joints, while the unopposed long extensor muscle causes extension at the metatarsophalangeal joints. A similar mechanism is responsible for the clawing of the great toe. At the same time the overacting long flexor tendon pulls the forefoot downwards, and the long extensors, even if normal, cannot hold it up. The contractures in the soft tissues will proceed with the deformity, and, if the condition is left untreated, changes will occur in the bones of the foot according to Wolff's law. These are seen as a wedging of the smaller tarsal bones, especially of the scaphoid and cuboid.

The next stage, the fourth, is the same as the previous one, with the addition of a pronounced varus and adduction deformity confined mainly to the forefoot. This is brought about by the continual overaction of the long flexor muscles. The tissues on the inner side of the foot will be contracted as in a congenital *talipes equino-varus*. Later, if the deformity is allowed to persist, further changes will occur in the bones.

The last stage, a most pitiable condition and rarely seen, is that in which the foot is in a rigid equino-varus deformity, but added to it are circulatory changes. The toes are blue, contracted and covered with painful callosities, while the deformity involves all the structures of the foot from the skin to the bones.

In an untreated case the passage from one stage to the next is gradual. As in all deformities, there is a postural stage before the onset of the structural change; once the latter is reached it is permanent, and any increase in the deformity will then be structural. As has been mentioned, a claw-foot due to infantile paralysis generally reaches a certain stage and remains stationary, while that due to lesions of the central nervous system, such as Friedreich's ataxia *et cetera*, is progressive.

Clinical Features.

The condition may be arrested at any stage, and can be conveniently described as a claw-foot of first, second, third, fourth or fifth degree. First degree claw-foot causes symptoms similar to those of a tight *tendo Achillis*, but the insufficiency of the intrinsic muscles reflects itself in some contracture of the plantar fascia. In the other stages the diagnosis is readily made, and the clinical features have been presented under the previous heading.

There is one condition which may cause difficulty in the diagnosis to those who are not thoroughly conversant with orthopædic pathology, and that is a falling of the transverse arch with fixed clawing of the toes and a tight *tendo Achillis*. In most of the latter cases there is no cavus deformity, and, if the condition is superimposed on a longitudinal arch which is naturally high, it can be ruled out by the absence of any abnormal tightness of the plantar fascia and the presence of osteophytes, or, as some prefer to call them, hyperostoses, on the inner side of the dorsum of the foot at the tarso-metatarsal joints.

The Treatment of Acquired Claw-Foot.

The scheme of treatment is as follows.

1. All that is needed in those cases classified as first degree claw-feet is a stretching of the *tendo Achillis* by the addition of a metatarsal bar, the lowering of the heel or a manipulative stretching of the tendon under an anæsthetic. In the latter instance a plaster cast is applied with the foot in the corrected position and the knee is flexed to almost a right angle, the plaster cast ending just below that joint. By this means the tendon is stretched further as the patient extends his knee.

2. The next method of attack is tenotomy of the plantar fascia, accompanied by wrenching with a hand wrench and the application of a plaster cast with the foot in a slightly over-corrected position. This cast is left on for six weeks, during which period walking is not allowed. It is followed by a second cast which is furnished with a "Sorbo" rubber heel, on which the patient can walk. This latter cast is kept on until it wears out. When the plaster is eventually removed, the patient is supplied with an appropriate night splint which must be worn for a considerable time. The patient or the patient's parents are instructed that it must be worn for at least two years; with those instructions, most patients will use it for nine months.

Some of the patients on whom it is decided to perform a tenotomy of the plantar fascia will have obvious clawing of the toes, even when the head of the first metatarsal can be lifted up by pressure on its under-surface, and will need a tenotomy of the extensor tendons. The easiest way to decide if this is necessary is to obtain as much correction as possible with the wrench in position; if the extensor tendons are unduly tight and the hyperextension at the metatarsophalangeal joints cannot be readily corrected, a tenotomy of these tendons is indicated. Until a few years ago it was the custom to perform tenotomy on the flexor tendons as well as on the extensors. Now, however, if the dislocation at the metatarsophalangeal joints cannot be reduced after the attack on the bones or soft tissues of the foot, a Keller's operation is performed on every toe rather than a removal of any of the substance of the metatarsals.

During the application of the plaster cast it is essential to see that the toes are straight at the interphalangeal joints and flexed at the metatarsophalangeal; the safest way to procure and retain this position is to mould the cast well up under the heads of the metatarsal bones and leave the dorsal surfaces of the toes exposed.

When performing tenotomy of the plantar fascia, insert the knife as far back in the foot as possible so as to avoid the plantar vessels and nerves; make the first cut as near the tuberosity as possible,

whilst the succeeding ones are made fanwise. This is done to prevent the skin from yielding during the wrenching.

It is not necessary, nor is it desirable, to perform a tenotomy of the *tendo Achillis* in many of these cases, as a manipulation with the wrench will bring about a considerable amount of stretching. If it is considered necessary, a plastic tenotomy may be performed when all the correction possible has been secured; for if the *tendo Achillis* is not intact, there is no fulcrum against which to work with the wrench.

3. In those cases in which there is paralysis or marked paresis of the *tibialis anticus* and the *extensor hallucis longus* is considered sufficiently strong, the transplantation of the latter into the head of the first metatarsal bone is a procedure well worth trying. Many of the patients who had this done some years ago, however, are returning now and need some bone operation. Before this transplantation is done as much correction as possible is secured by means of tenotomies and wrenchings. It was frequently combined with a Steindler's operation, in which all the soft structures were stripped from the under-surface of the *os calcis* and any other tight structures in the vicinity were divided. This latter operation has been practically discarded by the Liverpool orthopædic surgeons, on the ground that it causes too much scar tissue, which is liable to contract and leave a foot very difficult to treat, if there is any recurrence of the deformity. There are cases, however, in which this operation is very beneficial and necessary. To decide the cases in which it will be needed, all patients who do not require a bone operation are put down for a Steindler's operation, so that the instruments will be ready. Tenotomies and a wrenching are done; if sufficient correction cannot be obtained, the open operation is proceeded with. A medial incision is preferable to that used originally by Steindler, for through it all tight structures on the inner side of the sole of the foot can be adequately attacked. The after-treatment is the same as after tenotomy of the plantar fascia.

4. The next line of attack is some operation on the bones. The question which puzzles most surgeons is, when is it necessary to resort to these operations. The answer is very simple: when there are changes in the bony structure of the foot as revealed by X rays or even by clinical examination. If you see a claw-foot which has been present for some years, and, on attempting to correct the cavus, you cannot make the plantar fascia stand out more prominently, then it is reasonable to assume that changes in tissue other than the soft parts are present.

Operations on the Bones.

The operations in use are the following.

Osteoclasis of the Foot with an Osteoclast.

Osteoclasis of the foot is to be condemned because of the multiple fractures it produces, and the consequent rigid arthritic foot which follows.

Wedge Operations.

If there is a straight-out cavus deformity of the foot, a simple transverse wedge removed from the dorsum of the foot at the apex of the deformity is all that is considered necessary. This is done without any consideration of the bones or joints, and because of this, I think, is unsound.

If there is some degree of varus added to the deformity, a crescentic wedge is removed from the outer side and dorsum of the foot. Again no consideration of the bones or joints is shown, and this operation is subject to the same criticism as the simple transverse wedge operation.

Removal of the Head of the Astragalus.

Removal of the head of the astralagus will allow the deformity to be corrected, but, more often than not, it leaves a painful foot. The same criticism can be applied to the method of removing a wedge during an arthrodesis of the mid-tarsal joint, for it is the same as fusing only half a joint. The sub-astragaloid element of the joint is left free and is frequently the seat of pain.

Astragalectomy.

Used extensively by American surgeons, astragalectomy is not regarded with much favour by the English surgeons, mainly because it is very difficult to do anything later if the operation turns out a failure. An exception to this will be mentioned later.

Naughton Dunn's Operation.

Some modification of Naughton Dunn's operation is very useful and can be employed for any of the deformities that may be encountered. The appropriate wedging is easily calculated, and the posterior displacement of the foot brings the weight-bearing nearer the apex of the deformity, with less risk of recurrence. When performing a Dunn's operation, do not remove more bone than is necessary to procure ankylosis between the *os calcis* and the cuboid, because the more bone that is removed, the less posterior displacement of the foot is possible after excision of the scaphoid. If the foot is dislocated at the subastragaloid joint to allow a better exposure of the articular surfaces of the astragalus and *os calcis*, and if the peroneal tendons are divided, it is just as well to suture the latter again. In many cases it is possible to clean away the articular cartilage without dislocating the foot inwards or dividing the tendons, but, if difficulty is experienced, this manœuvre will facilitate matters.

Before any of these bone operations it is essential to perform a tenotomy of the plantar fascia, or even some modification of Steindler's procedure, for after the bone operation there is very little risk of the deformity returning. There is, however, always the risk of a piling-up of a heap of scar tissue in the posterior part of the plantar surface of the foot.

The after-treatment of patients who have undergone these bone operations is of more importance than the operation itself. A padded plaster cast is applied with the foot in the corrected position. If a Dunn's operation has been used, be sure that the assistant does not hold the foot up by the great toe during the application of the cast; the foot must be held in its posteriorly displaced position. At the end of three weeks the cast is removed, sutures are appropriately dealt with and any necessary correction in the position of the foot is carried out before the renewal of the cast. For the simpler procedures the cast does not remain on any longer than three months, unless, of course, at the end of that period bony union is not firm, in which case it is left *in situ* until firm bony union has taken place. After Dunn's operation, the longer the cast is worn, the better is the end result; a period of at least four months is recommended.

Although the foot is shortened by any of these procedures, it may be necessary to perform tenotomy on the extensor tendons, but on no account should this be done to the flexors of the toes.

In some instances it will be found that the first metatarsal cannot be brought up into line with the rest of the foot after any of these bone operations; this is due to the change in shape of the inner and anterior tarsal bones, and can be rectified by means of an osteotomy of the first metatarsal.

Other Operative Procedures.

A patient with fifth degree claw-foot generally comes to the surgeon with a request for immediate amputation, and in many cases this is performed. A very useful and, what is more, a painless foot can be produced by the following procedure. An astragalectomy is performed, and then the forefoot is amputated through the necks of the metatarsals. When I first saw this done, I inquired why the same effect could not be produced by a modification of Dunn's operation, and was informed that bony union had failed to take place in several cases in which it had been attempted. This is readily appreciated when you consider the circulatory disturbances in these feet.

The question whether the claw-foot of Friedreich's ataxia or pseudo-hypertrophic muscular atrophy should be corrected occasionally arises. On this score nobody can be dogmatic; each case must be judged on its merits. It is well known that, if some of these patients are taken off their feet for any length of time, it will be found very difficult to induce them to walk again. The longer these patients can be kept on their feet, the better.

Lambrinudi's Operation.—I cannot speak very authoritatively on the subject of Lambrinudi's operation, because I have seen it employed on only two occasions. One patient I saw eight months after operation, and the other only three months after operation. In both pronounced decrease in the deformity had taken place. The former patient had been walking with much greater comfort than previously. Both these patients would have been described as having third degree claw-feet. Lambrinudi's operation consists of the fusion of all the interphalangeal joints of the toes along with the division of the structures on the dorsal surface of the metatarsophalangeal joints. The idea is to abolish the clawing of the toes, and allow the long flexors to act on the metatarsophalangeal joints and thus replace the small muscles. Lambrinudi states that the cavus deformity disappears in all cases, and that the forefoot is pulled up by the long extensors of the toes, as their action on the metatarsophalangeal joints is counterbalanced by the long flexors. There is no doubt that the procedure is reasonable, and resembles the operation described by Glissan for flexion contracture of the toes. I do not know whether the latter has used this method for claw-feet.

The Treatment of Claw-Foot due to Congenital Causes.

It is frequently asked whether anything in the nature of a laminectomy should be performed in those cases in which there is *spina bifida occulta*. The safest rule to adopt is the following: laminectomy is indicated in those cases in which the onset of nervous symptoms is late, that is, if the patient was not born with them. If the claw-foot is the only external evidence of the spinal anomaly, I certainly do not consider laminectomy advisable. If, however, there are disturbances of micturition or sensory changes, I think it is a measure which offers some hope of relief.

Summary.

Claw-foot may be treated by the following means.

1. A metatarsal bar may be used, the heel of the shoe may be lowered, or a manipulative stretching of the *tendo Achillis* may be carried out.

2. Tenotomy of the plantar fascia or Steindler's operation may be performed. Wrenching and a plaster cast may be used as well.

3. Tenotomy of the plantar fascia or Steindler's operation may be performed, in addition to transplantation of the *tibialis anticus* tendon into the neck of the first metatarsal, tenotomy of the extensor tendons, or even a Keller's operation on every toe.

4. The second or third measures may be used, in addition to a lengthening of the *tendo Achillis*.

5. Tenotomy of the plantar fascia or a Steindler's operation may be performed, followed by the removal of a bony wedge, or excision of the head of the astragalus; or, better still, a Dunn's operation.

6. Astragalectomy and amputation of the forefoot through the necks of the metatarsals may be employed.

A NEW LINE OF TREATMENT IN A CERTAIN TYPE OF ARTHRITIS: A PRELIMINARY COMMUNICATION.

By EVA A. SHIPTON and L. J. A. PARR,
Sydney.

Two severe cases of acute rheumatoid arthritis, in which pronounced atrophy of the skin with a glazed tissue-paper-like appearance on the legs, arms and hands was a feature, recently came under our notice.

This class of case constitutes one of the groups of rheumatoid arthritis into which we hope subsequently to divide the disease. The appearances are so striking that they can be easily recognized.

Case Histories.

CASE I.—A female, aged sixty-six years, was admitted to a public hospital, suffering from an acute arthritis of wrists, fingers, elbows, shoulders, knees, ankles and metatarsal joints. This condition had apparently come on acutely after extraction of teeth and subsequent vaccine therapy for a previous chronic arthritis. The precipitation of an acute arthritis after vaccine therapy in this type of case has been previously noted by us on two occasions. The patient had a fluctuating temperature for eight weeks. The glazed appearance of the skin developed rapidly, and also atrophy of the muscles. She rapidly lost weight. Crookes's colloidal sulphur was given in doses of one cubic centimetre every alternate day, but was apparently not of very great value. Insulin and glucose were given to combat the loss of weight.

After the fever subsided the condition continued to progress and the patient left hospital with the joints as bad as when she entered. Three days later she came under our observation and treatment.

On examination, deformity of the shoulders, elbows, wrists and fingers was observed, as well as slight flexion deformity of the knees and swelling of practically all these joints. Movement was extremely painful. The patient made no attempt to carry out any movements whatsoever. She also suffered from a distended abdomen and severe constipation, which had apparently increased during the illness.

The atrophic condition of the skin was so pronounced that on the patient's admission to hospital it was at once noted by the nursing staff. The atrophic appearance involved the whole of the legs below the knees and for ten centimetres (four inches) above the knee joints. The hands and a small area above the wrists were involved. The skin over the joints was slightly cyanotic, but examination of the palmar surface of the hands revealed pink finger-tips and distended venules on the second and third phalanges.

Although the patient had no rise in temperature at this stage, her cheeks were brightly flushed towards the afternoon, their appearance almost resembling the malar flush of the tuberculous patient. She was starved for four days. The condition of the joints improved and the skin improved slightly. She was then given an ordinary diet for four days and starved again for four days. After this she could move her knees slightly, also her wrists and fingers. The administration of insulin and glucose was then commenced. She was given a full diet and also intramuscular injections of cystein (Hoffman La Roche). She received each day one ampoule containing 0·2 gramme.

Within forty-eight hours dramatic improvement began, and the patient could sit up in bed by herself for the first time for months. Three days later she was taken out of bed, and made an attempt to walk between two nurses. Her feet were painful, as the metatarsal arch was damaged by either disuse or disease; but this was rectified by the use of a metatarsal bar on the shoe.

Improvement continued. The pain and swelling disappeared and movement increased, so that one month after coming under our care she could walk by herself a short distance. The most noticeable features were the rapid diminution of pain, increased mobility and increased muscle power, which rapidly manifested themselves while she received cystein. The atrophic, glazed appearance of the skin entirely disappeared after the fourth injection of cystein. The patient still has contracted shoulder joints, and there is a diminution of other movements due to scar tissue.

The rapid improvement in this case was in our opinion due to: (i) the preliminary period of starvation and (ii) the injections of cystein. We consider the second the more important.

This patient is still under treatment, and we have commenced gold therapy; but, judging by our previous experience in this variety of arthritis, we can regard it only as an adjunct. Another noticeable feature in this case was the rapid subsidence of the cyanosis of the skin over the joints, which we have found in other cases of this type extremely difficult to alter.

This patient had complete achlorhydria and secondary anæmia.

CASE II.—A nurse, aged twenty-eight years, three months prior to coming under observation contracted scarlet fever in a country hospital. Her elevated temperature failed to subside completely, and three weeks from the onset of the fever both her knees were affected by an acute arthritis. Her feet and ankles became involved, as well as some of the joints of her hands. Her tonsils had been removed eighteen months before, and she had had attacks of pyelitis due to a *Bacillus coli communis* infection during the previous twelve months.

The condition of her joints continued to grow worse, and it was noticed that although she was ambulatory, her temperature rose to 37·8° C. (100° F.) at night. She was then sent to hospital under observation. The temperature was found to vary between 37·4° C. and 37·8° C. (99·2° F. and 100° F.) at night. The skin of the lower limbs below the knees had a pronounced glazed tissue-paper-like appearance, and was tender to touch. The skin over the knee joints was only slightly affected. Attempts at culture from the blood yielded no organisms.

The blood sedimentation rate was three millimetres at the end of one hour. This was confirmed about a week after the patient entered hospital. A slight degree of anæmia was present, but there was a normal leucocyte count without a shift. Examination of a throat swabbing revealed *Streptococcus viridans*. The patient was given intravenous injections of three cubic centimetres of a 10% solution of mercurochrome, the dose being slowly increased every day until it reached eleven cubic centimetres. In consequence of slight gingivitis this treatment was stopped after several days. Adrenaline was given hypodermically, the dose being increased every day up to 0·4 cubic centimetre (seven minims), as her blood pressure was low (the systolic being 100 and the diastolic 70 millimetres of mercury), and it was thought that she might have suffered some suprarenal damage. There was a pronounced local reaction to the adrenaline.

Under this therapy the joints improved so that the patient could move her knees slightly. Cystein was added after ten days, and one ampoule was given each day for seven days. Her elevated temperature, which had not subsided until cystein was added to the treatment, dropped rapidly to normal, and the improvement of the joints and skin was so dramatic that within seven days she had full flexion of her left knee joint without pain and almost full flexion of the right knee joint. The atrophic skin had entirely disappeared. At this stage she was allowed out of bed, as there was no pain or stiffness.

Discussion.

From previous experience of this particular variety of rheumatoid arthritis it would seem that cystein produced a rapid and definite effect which

has not been previously seen. A full discussion of this problem will not be given here; but it is interesting to note that the recent work of Hench, if interpreted in the light of previous research done by Carr and Foote,[1] also points to the fact that retention of cystein, the reduction product of cystine in the blood, may be the curative agent for arthritis in jaundice.

Moreover, the beneficial effects of pregnancy on arthritis may be due to increased formation or retention of amino-acids, as it has been shown[2] that a connexion exists between the elaborated products of the pituitary and compounds of the β-imino zylol type (histamine, histidine and tethelin). Also, the presence of cystine has been demonstrated in crystalline insulin.

Histidine was used by us first in arthritis; but in only one case out of three was there any definite sign of amelioration. The beneficial effect of operative procedures upon rheumatoid arthritis may be due to the excessive autolysis of tissue protein, the sources of amino-acids in the body being digested food proteins and autolysed tissue proteins.

We have noticed for years that patients with achlorhydria and arthritis are extremely difficult to cure and are also very subject to relapses. May not the achlorhydria be a factor leading to imperfect protein digestion and resultant diminished formation of amino-acids? Moreover, in these patients with achlorhydria the normal secretion of mucus is disturbed. Mucus contains cystine, histidine and tryptophane; and, according to the recent work of Mahlo,[3] it is digested in the duodenum and the amino-acids are reabsorbed in the normal person. May not a disturbance of this process lead to a deficiency of amino-acids, in particular cystine, in certain types of arthritis? As the skin contains cystine and tyrosine, and as the skin metabolism is disorganized in arthritis, an observation of countless workers in many countries, we felt that cystine or tyrosine might be concerned with some of the metabolic disturbances.

Accordingly, cystein was the second amino-acid to be tried. It is possible that some of the results obtained with colloidal sulphur may be due to the injected sulphur aiding some metabolic processes and leaving free the cystein for the more important tissue metabolism. The injected colloidal sulphur may not be an efficient substitute for cystein, or may not be metabolized into cystein. The fact that patients suffering from rheumatoid arthritis treated with gold experience outstanding improvement of their joints with very small doses if an extensive skin rash occurs again, suggests that the same amino-acid, cystine, may be involved.

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THE PRECIPITIN TEST APPLIED TO MELBOURNE HÆMOLYTIC STREPTOCOCCI.

By HILDRED M. BUTLER, B.Sc. (Melbourne),
Melbourne.

(From the Baker Medical Research Institute, Alfred Hospital, Melbourne.)

IN 1933 Lancefield,[1] by means of a precipitin test, showed that the hæmolytic streptococci could be divided into a number of groups—*A, B, C et cetera*—and that there was a good correlation between the various groups and the sources of the strains. All except two of 106 strains isolated from man, other animals, milk and cheese were classified by her into five groups. According to this test, 23 strains belonged to group *A* and 21 of these were from human sources. Of 21 strains classified as group *B*, 18 were of bovine origin. There were 49 group *C* strains, 38 being from animals other than cattle; the remaining 11 were from cows. Eight strains of group *D* and three group *E* strains were from cheese and milk respectively. The group specific substances, called by Lancefield the "C" substances, which form the basis of this test, have been shown to be carbohydrates.

Before the introduction of Lancefield's precipitin test, certain biochemical tests had proved of value in determining the origin of cultures of hæmolytic streptococci. The most useful of these were (i) the final pH in glucose broth, (ii) the hydrolysis of sodium hippurate, (iii) the reduction of methylene blue in milk, (iv) the ability to grow on bile blood agar and (v) the fermentation of trehalose and sorbite. At the time of Lancefield's publication the position of these tests was briefly as follows.

1. Bovine mastitis strains produced a low pH in 1% glucose broth, usually about 4·4, whereas strains of human origin gave a pH usually above 4·8.

2. Typical bovine strains split sodium hippurate, while strains from other sources only rarely did so.

3. Strains of human and bovine origin were unable to grow in milk containing a certain concentration of methylene blue, whereas some strains from cheese and similar sources were able to multiply in such media and reduce the dye.

4. Strains of bovine origin grew on blood agar containing 40% bile, whereas most other strains rarely did, many of the latter failing to multiply even on blood agar containing 10% bile.

5. Strains from human sources fermented trehalose but not sorbite, while strains of animal origin other than bovine usually fermented sorbite but not trehalose.

Lancefield found good agreement between her precipitin classification and the biochemical reactions of the strains she tested. Thus none of her group *A* strains split sodium hippurate, reduced methylene blue in milk or fermented sorbite, while all fermented trehalose and gave a pH of 4·8 to 5·2 in 1% glucose broth. Only one strain grew

on blood agar containing 40% bile, and only four others grew with 10% of bile. All group *B* strains split sodium hippurate, grew on blood agar containing 40% bile, and gave a final pH of from 4·4 to 4·6. Methylene blue was not reduced; trehalose was fermented, sorbite was not.

Biochemically, her group *C* strains resembled group *A*, in that none hydrolysed sodium hippurate or reduced methylene blue; but they differed in that none of group *C* fermented trehalose and 47 out of 49 fermented sorbite. Although only one grew at all on blood agar containing 40% bile, all but ten showed some growth on blood agar containing 10% bile. The final pH in glucose broth varied from 4·6 to 4·9. The strains belonging to groups *D* and *E* were obtained from milk and cheese, and differed biochemically from the three preceding groups.

Since 1933 further groups have been differentiated. Groups *F* and *G* were added by Lancefield and Hare[2] in 1935, and groups *H* and *K* by Hare[3] in the same year. Group *F* strains grow slowly on blood agar plates, giving rise to minute transparent colonies surrounded by a narrow zone of hæmolysis, and are identical with the "minute hæmolytic streptococci" of Long and Bliss[4] (1934). Group *G* strains resemble both groups *A* and *C* in certain particulars. Some degree of cross-precipitation with *C* antisera has been recorded. They do not split sodium hippurate or ferment sorbite. Most strains grow on blood agar containing 10% bile, and some on blood agar containing 40% bile. The final pH is variable. Figures from 4·4 to 5·4 have been reported. Until recently most of the *G* strains described had been isolated from man; but in 1938 T. Hare and Fry[5] showed that streptococci of this group were frequently associated with infections in dogs. The strains of groups *H* and *K* described by Hare were isolated from the nose or throat of normal persons, and are not considered important from the standpoint of human disease.

Among the original group *C* strains studied by Lancefield there were none of human origin. None of the strains described by her fermented trehalose. This group is now known to contain three well-marked subgroups, according to their action on trehalose and sorbite (Edwards,[6] 1934). Most of the trehalose-negative, sorbite-negative strains have been isolated from horses, especially from cases of strangles. The second subgroup ferments sorbite, but not trehalose. The majority of Lancefield's original strains belonged to this subgroup and were obtained from infective conditions in a variety of animals. The third subgroup, trehalose-positive, sorbite-negative, contains strains from both human and animal sources. Three of Griffiths's 27 types of human pathogenic hæmolytic streptococci belong to this *C* subgroup.

From the standpoint of human infections the important groups are *A*, *B*, *C* and *G*. Group *D* streptococci have all the characteristics of enterococci, and have been isolated chiefly from cheese and from human fæces. The few *E* strains described have been isolated from milk. The *F* strains have been obtained from the human throat, and according to Topley and Wilson[7] (1936) may possibly be responsible for some cases of tonsillitis. As mentioned above, the *H* and *K* strains were obtained from normal persons.

Strains of groups *D*, *F*, *H* and *K* do not, when tested by the usual methods, produce soluble hæmolysin. This simple test enables one to limit the number of strains to be examined by the precipitin test, and also the number of group antisera to be used. Some group *B* strains fail to produce soluble hæmolysin; but such strains can be readily identified apart from the precipitin test by their action on sodium hippurate, the low pH in glucose broth, and the production of a characteristic orange-brown pigment when grown in tryptic broth.

A further test of importance is the detection of fibrinolytic strains. Most of the group *A* strains and also many *C* and *G* strains are able to digest human fibrin. The strains of the other groups, however, do not possess this power.

Of the original strains tested by Lancefield, all but two from human sources were group *A*. Two years later Lancefield and Hare[2] concluded that practically all severe human hæmolytic streptococcal infections, in the puerperium at least, were caused by streptococci belonging to group *A*. Streptococci of the other groups gave rise to mild infections only. In January of this year Fry[8] described three fatal cases of infection in the puerperium by *Streptococcus hæmolyticus* group *B*. These three cases differed in both their clinical course and their morbid anatomy from infections due to group *A*.

Coffey[9] (1936) mentioned a few severe and fatal infections due to other than group *A*.

Thus, although it is now established beyond doubt that group *A* streptococci are responsible for the majority of severe and fatal streptococcal infections in man, some of the other groups do play some part in the production of human disease. For this reason alone it appears justifiable to report the results of an examination of 113 strains of hæmolytic streptococci isolated in Melbourne from human sources, since a number of them did not fall into Lancefield's group *A*. A further reason for publishing this work is that, up to the present, those who have reported the results of grouping Australian strains from human sources have apparently not attempted to classify those strains which did not belong to group *A* (Chesterman,[10] 1938, Bryce and Tewsley,[11] 1938).

In addition to the precipitin tests, the strains reported in this paper were studied biochemically.

Source of the Strains of Streptococci Examined.

The source of the strains examined is given in Table I. One or more cultures were obtained from 110 patients, three of which yielded hæmolytic streptococci belonging to two different groups. All the strains except two (both group *B*) produced soluble hæmolysin. During the period when these 113 strains were isolated (from July 1, 1936, to March

TABLE I.

Strains from Puerperal and Abortal Infections.			Strains from Non-Puerperal Infections.		
Number of Patients.	Sources of Strains.	Number of Strains.	Number of Patients.	Sources of Strains.	Number of Strains.
63	Culture from blood	16	47	Culture from blood	8
	Culture from vaginal swabbings	47		Culture from pus and from pleural, joint and peritoneal fluids	32
	Miscellaneous	1		Culture from throat swabbings	7
				Culture from urine	2
		64			49

31, 1938) eight strains of hæmolytic streptococci (not group *B*) were encountered, which failed to produce soluble hæmolysin. These latter strains are not dealt with in this paper.

In Table II the diagnosis in each of the 47 non-puerperal cases is given.

TABLE II.

Diagnosis.	Number of Cases.	Diagnosis.	Number of Cases.
Septicæmia	4	Infected wounds or burns	3
Endocarditis	1	Sore throat, tonsillitis	6
Pneumonia	5	Osteomyelitis	1
Cellulitis	9	Chronic ulceration	4
Abscesses	4	Infection of urinary tract	2
Mastoiditis	2	Pulmonary hydatid	1
Arthritis	3	Gangrenous finger	1
Peritonitis	1		

Preparation of the Hydrochloric Acid Extracts for Lancefield's Precipitin Tests.

The hydrochloric acid extracts for Lancefield's precipitin test were prepared as follows:

One hundred cubic centimetres of an eighteen-hour tryptic broth culture were centrifuged, and the deposit was taken up in two cubic centimetres of saline solution containing sufficient hydrochloric acid to make the final concentration N/20 hydrochloric acid. This suspension was heated in a water bath at 100° C. for ten minutes. After having been cooled, the suspension was centrifuged and the supernatant fluid was neutralized with soda; it was then recentrifuged and the resulting supernatant fluid was used as the extract for testing with the group antisera.

Preparation of Group Antisera.

The group antisera were prepared as follows:

Sera for groups *A*, *B*, *C* and *G* were prepared in rabbits by the intravenous injection of emulsions prepared as follows. The strains were grown in tryptic broth (Hartley) containing 0·05% glucose for eighteen hours. The resulting growth was washed once in saline solution and then suspended in saline solution containing 0·2% formaldehyde, so that the volume was one-twentieth of that of the original broth culture. The suspensions were placed in the ice chest, and before use were diluted with saline solution to an opacity corresponding approximately to two thousand million per cubic centimetre.

To immunize the rabbits, one cubic centimetre of the diluted emulsion was injected on three successive days. After four days' rest the injections were repeated, and after a further four days a small bleeding was taken and tested for specific group precipitin. If no appreciable amount of specific precipitin was detected, two further series of injections were given before the serum was again tested, and so on. As soon as the fortnightly test gave a positive result with the specific extracts diluted to one in eight, the rabbits were tested weekly until positive results were obtained at an extract dilution of one in sixteen at the least. When this occurred, a large amount of blood (40 to 50 cubic centimetres) was taken, sometimes in two stages, at an interval of twenty-four hours. The serum obtained was stored without antiseptic in the refrigerator.

If after six courses of injections very little group precipitin was detected, the emulsion used for the injection was made five times as strong.

I have found that during the summer months it is more difficult to obtain satisfactory sera. Thus in August and September of 1937 it took three, seven and six weeks respectively to prepare satisfactory antisera for groups *B*, *C* and *G*; while, starting in November of the same year, and using rabbits of the same stock and the same *C* and *G* strains, it took more than three months. Similarly rabbits on which injections were begun in April, 1938, for groups *A*, *B*, *C* and *G*, yielded satisfactory sera within six to eight weeks.

If after the final bleeding the rabbit is allowed to rest for two to three months, the injections can then be recommenced. Under these conditions it is advisable to take blood from the rabbits weekly, as the titre may rise more rapidly than in new rabbits.

Each antiserum was tested against extracts prepared as above from several strains belonging to the group concerned, and also against at least one strain belonging to each of the other three groups. The serum, which was used undiluted, was layered in quantities of 0·2 cubic centimetre with 0·4 cubic centimetre of the extract, undiluted and diluted one in four, one in eight, one in sixteen, and one in thirty-two. After having stood for ten minutes the tubes were examined for the presence of a ring of precipitate at the junction of the two fluids. The tubes were then shaken and placed in the water bath at 37° C. for two hours, when the amount of precipitate formed was noted. Final readings were made after the tubes had stood for a further eighteen hours in the cold. If a ring was present at the end of ten minutes, and if at the end of the two hours at 37° C. or after having stood overnight, the tube contained an easily detected amount of precipitate, the reaction at that particular dilution was regarded as strongly positive. If no definite ring formed, but the typical granular precipitate was present after the tube had been left standing, the reaction was considered positive, but not strongly so.

A particular group antiserum was considered satisfactory if a positive reaction was obtained at

a dilution of one in sixteen with hydrochloric acid extracts made from several different strains of the particular group, while with extracts of strains belonging to the other groups there was no reaction at any dilution. In some instances positive reactions were observed with extracts from strains other than those belonging to the same group as the one used for the injections. If these cross-reactions occurred only with the undiluted extracts, and if the reactions with extracts of strains of the group injected were strongly positive at a dilution of one in thirty-two, the serum was considered satisfactory.

Thus one of the group *C* antisera used by me gave a strongly positive reaction at a dilution of one in thirty-two with hydrochloric acid extracts of strains belonging to group *C*; it also gave a positive reaction with undiluted hydrochloric acid extracts of some known group *A* strains, but never with these latter extracts if diluted to one in four or more.

The group *A* antisera, used to classify the strains considered in this paper, were prepared from two strains, "Kennet" and "Prest", both of which had been isolated from the blood of fatal cases of puerperal fever. Biochemically they were typical of group *A*; and extracts prepared from them reacted strongly with the group *A* antiserum sent to me by Dr. Leonard Colebrook, but not with antisera for groups *B*, *C* and *G* from the same source. The antisera prepared by the injection of these two strains reacted strongly with extracts of the group *A* strains, but not at all or only very slightly with extracts of the group *B*, *C* and *G* strains sent to me by Dr. Colebrook. The antisera for groups *B*, *C* and *G* were prepared with these known strains.

To date no group antiserum which has failed to react with a one in four dilution of a hydrochloric acid extract has given a positive reaction at a higher dilution, although one or two sera have reacted only faintly with undiluted extracts and very strongly with the same extracts when diluted one in four or more.

Grouping of the Strains by Lancefield's Method.

All hydrochloric acid extracts of strains to be classified were tested undiluted and diluted one in four, with all the four group antisera. If a positive reaction was observed with any antiserum the extract was set up in higher dilutions with this serum. If an extract gave a strongly positive reaction at a dilution of one in eight or higher, with group *C* antiserum for example, and no reaction with the other three sera, this particular strain was classified as group *C*. If cross-reactions were observed with the undiluted extracts only, while with one particular antiserum a strong reaction was obtained at a dilution of one in sixteen or higher, the strain was classified as belonging to the latter group. If, however, cross-reactions were observed with dilutions of the extract, it was considered unjustifiable to allot the strain to any particular group on the basis of this test alone.

Results of Lancefield's Precipitin Test.

According to Lancefield's precipitin test, the 113 strains were grouped as follows: 64 belonged to group *A*, 10 to group *B*, 7 to group *C*, 7 to group *G*, and 25 could not be allotted with certainty to any of the above groups. Eighteen of these latter strains reacted with more than one serum, in such a way that they could not be placed in any one group; the remaining seven gave no significant precipitation with any of the four sera.

The Strains Unclassified by Lancefield's Precipitin Test.

There were 18 strains, the hydrochloric acid extracts of which gave a positive reaction to the precipitin test with more than one group antiserum. Although in some instances the reaction with one particular serum, for example, group *A* antiserum, was as strong as that obtained with known strains of that group, the strength of the reaction with the other serum or sera was stronger than was ever observed when known group *A* strains were tested with the same antisera.

Sixteen strains reacted with both *A* and *C* antisera; some of these also reacted with the antiserum for group *G*. The other two strains gave positive results with both *C* and *G* antisera. The types of reaction observed are given in Table III.

TABLE III.

Number of Strain.	Group Serum.	Reaction with Dilutions of Extract.			
		One in One.	One in Four.	One in Eight.	One in Sixteen.
88	*A*	+[1]	+	+	±[2]
	B	−	−	−	−
	C	+	+	±	−
	G	+	±	−	−
96	*A*	+	+	+	+
	B	−	−	−	−
	C	+	+	−	−
	G	+	±	−	−
106	*A*	+	+	+	−
	B	−	−	−	−
	C	+	+	±	−
	G	+	+	+	−
108	*A*	−	−	−	−
	B	−	−	−	−
	C	+	+	+	−
	G	+	+	±	−

[1] + = Formation of ring followed by formation of granular precipitate.
[2] ± = No ring formation followed by formation of granular precipitate.

Lancefield[1] (1933) spoke of the notable lack of cross-reactions between the groups. Only five of the 106 strains she tested gave cross-reactions; and in four instances the reaction with one particular serum was strong enough to make the proper classification evident, even without the confirmatory evidence of the biochemical tests. She reported, however, one peculiar reaction. One unclassified strain, *K*130, behaved as follows. Antisera prepared against this strain reacted with it alone out of the 106 strains in her series. A strong cross-reaction was observed between extracts of this

strain and two antisera against strains of group *A*, although other antisera prepared against the same group *A* strains at the same time showed no trace of cross-reaction.

Plummer[12] (1935) stated that no strain gave a positive reaction with more than one group antiserum, although in another part of her paper she mentioned that it was necessary to wash the bacterial growth with saline solution before extraction with acid, in order to avoid slight cross-precipitation. This procedure was tried with several of my strains reacting with both group *A* and group *C* antisera; but extracts so prepared still reacted with both the *A* and *C* sera.

Hare[3] (1935) found that of 100 strains producing soluble hæmolysin, four could not be placed in definite groups owing to extracts of these strains reacting with more than one group antiserum. The precipitin reactions he observed with the four strains are given in Table IV.

TABLE IV.

Number of Strains.	Precipitation with Sera of Group.							
	A.	*B.*	*C.*	*D.*	*F.*	*G.*	*H.*	*K.*
1	±	±	+	−	±	+	−	−
1	+	−	+	−	−	±	−	−
1	+	−	+	−	−	−	−	−
1	−	−	+	−	−	+	−	−

Davis and Guzdar[13] (1936) examined 78 strains and found that clear-cut reactions were obtained with 68. The remaining ten gave cross-reactions, but not to such an extent that the strains could not be allotted to the various groups. Thus two strains classified as group *C* gave faint precipitation with group *B* antiserum, and six gave a faint cross-reaction with group *G* antiserum; with two group *G* strains a faint reaction occurred with Group *C* antiserum.

More recent publications show that cross-reactions with the Lancefield technique are not as infrequent as appeared from earlier writings. Bliss[14] (1938) found that cross-reactions were particularly likely to occur with group *C* antisera. Eleven out of nineteen sera prepared by her against strains belonging to group *C* reacted with hydrochloric acid extracts of strains belonging to other groups, and also sometimes with organisms other than streptococci. In her experience antisera prepared against group *A* and group *B* strains were the only ones that did not give some cross-reactions.

Fuller[15] (1938), in describing the formamide method for the extraction of the polysaccharide for use in the group precipitin test, stated that routine extracts obtained by this method gave much less cross-reaction than Lancefield hydrochloric acid extracts from the same strains, clearly showing that with the latter type of extracts cross-reactions were by no means uncommon. Fuller also stated that the formamide method had produced group-specific extracts when the Lancefield method had failed to do so.

Fuller's formamide method is as follows:

Five cubic centimetres of an eighteen-hour glucose broth culture are spun down in the centrifuge, and the supernatant fluid is removed as completely as possible. One hundred cubic millimetres of formamide are added to the residue and the tube is shaken and placed in an oil bath at 150° C. for 15 minutes. The tube is allowed to cool and 250 cubic millimetres of acid alcohol (a mixture of 95 parts of anhydrous alcohol with 5 parts of twice normal hydrochloric acid) are added, mixed, and the precipitate removed by centrifuging. The supernatant fluid is drawn off by pipette and placed in a small tube, and 500 cubic millimetres of acetone are added. The tube is shaken, the precipitate is spun down and the supernatant fluid is discarded. One cubic centimetre of saline solution is added to the acetone precipitate and stirred. The part that does not dissolve is spun down and the supernatant fluid is removed to a small tube. One drop of phenol red indicator is added to the saline supernatant fluid, which is then neutralized with a trace of sodium carbonate and used as the extract for the precipitin test.

Extracts were prepared according to this method from the 25 strains which I had been unable to classify by the Lancefield method, and tested with antisera for groups *A*, *B*, *C* and *G* in the same way as the hydrochloric acid extracts had been tested.

All of the seven strains which had reacted with both *A* and *C* antisera when hydrochloric acid extracts were used, gave positive results with the *A* serum only when the extracts were made with formamide. Of the nine strains which had reacted with *A*, *C* and *G* antisera when the hydrochloric acid extracts were used, seven reacted with the *A* serum only, one reacted strongly with *A* serum and slightly with *C* serum, and one reacted with *G* serum alone. The two strains which had given a positive result to the precipitation test with both Group *C* and group *G* antisera belonged to group *C* according to Fuller's test. Six out of the seven strains which had failed to give a positive result to the precipitation test with the Lancefield technique yielded formamide extracts which reacted with group *A* antiserum; the formamide extract of the remaining strain failed to react with any of the group sera.

From the standpoint of serological grouping, these results showed that the formamide method of preparing the extracts for the precipitin test was decidedly superior to hydrochloric acid extraction, since with this method all but one of the twenty-five strains, which with Lancefield's method had remained unclassified, could be allotted to one or other of the four groups. Nevertheless, it was necessary to consider whether or not the cross-reactions I obtained with Lancefield's technique had any practical significance.

Certain observations suggested that this might be so. First, twelve of the sixteen strains, hydrochloric acid extracts of which reacted with group *A* antiserum and also with one or more of the other sera, were able to grow on blood agar plates containing 40% ox bile; while of the 64 strains, hydrochloric acid extracts of which reacted with group *A* antiserum alone, only one did so. Secondly, only three of these sixteen strains gave the typical dry flat colonies, usually characteristic of group *A*, in the primary cultures on blood agar plates; with

the other thirteen strains the colonies were smooth and domed. Thirdly, and probably most important of all, was the fact that none of these strains, all of which were obtained from cultures made from vaginal swabbing in cases of puerperal and post-abortal sepsis, was associated with serious infection, although only two of these patients were given "Prontosil". Lancefield and Hare[2] (1935) stated, and it has not since been disputed, that group *A* hæmolytic streptococci, if present in the vagina *post partum*, almost always give rise to serious puerperal infection. Yet here we have a number of strains of hæmolytic streptococci cultivated from the vagina, often in pure culture, which were not associated with serious infections, but which, on the basis of precipitin tests with formamide extracts, should belong to group *A*.

For these reasons it seemed advisable to arrange under five headings the 112 strains which had given positive reactions to group precipitin tests.

1. Under the heading of typical group *A* strains were classified those strains hydrochloric acid extracts of which had given a positive response to the precipitin test with only group *A* antiserum, and those which, although giving cross-reactions with the Lancefield method, were unable to multiply on blood agar plates containing 40% ox bile and which did not give domed colonies on blood agar plates.

2. Under the heading of atypical group *A* strains were included those which reacted with group *A* antiserum, but which differed from the typical group *A* strains in any two of the following three ways: (*a*) if they gave cross-reactions with one or more of the other group sera when diluted extracts were used; (*b*) if they grew on blood agar containing 40% bile; (*c*) if they gave domed, not flat, colonies on surface blood agar plates.

3. The third heading included group *B* strains.

4. Under the fourth heading were classified group *C* strains, including the two strains which reacted with both *C* and *G* antisera when hydrochloric acid extracts were used, but with group *C* serum alone when formamide extracts were used.

5. The fifth heading included group *G* strains, one of these strains having given cross-reactions with *A* and *C* antisera when a hydrochloric acid extract was used.

By the adoption of this scheme, 112 of the 113 strains examined could be grouped as follows: group *A*, typical, 70; group *A*, atypical, 15; group *B*, 10; group *C*, 9; group *G*, 8.

The Biochemical Reactions.

The biochemical tests employed were as follows: tests for (i) production of soluble hæmolysin, (ii) digestion of human fibrin, (iii) hydrolysis of sodium hippurate, (iv) final pH in 1% glucose broth, (v) growth on 40% and 10% concentrations of bile in blood agar plates, (vi) fermentation of trehalose and sorbite.

Except in two particulars the biochemical methods used were those described by Hare and Colebrook in 1934.[16] In tests for soluble hæmolysin, sheep red cells were used instead of those from the horse, since no regular supply of the latter is available in this laboratory. Since some workers have found that sheep red cells are less sensitive to streptolysins than those from horse or human blood, any strain which failed to give a positive reaction with sheep cells was then tested with human red cells. The result was considered negative only if, when the human cells were used, it was still impossible to obtain complete lysis of the 5% suspension of red cells within two hours. Hare and Colebrook recorded the results of five fermentation tests; in this paper only the results with trehalose and sorbite are given. In all other ways the details given by the above authors were followed exactly.

In Table V the results are summarized. The fermentation reactions are not included. All strains, except one of group *C*, fermented trehalose but not sorbite.

Reference to Table V will show that all but one of the seventy strains classed as typical members of group *A* digested human fibrin, and all failed to split sodium hippurate. Sixty-one strains failed to grow on blood agar containing 10% bile, and only one strain grew on plates containing 40% bile. Only three strains produced a pH below 5·0 in glucose broth.

The outstanding biochemical characteristic of the fifteen strains classified as atypical members of group *A* was their pronounced tolerance for bile: all grew on plates of blood agar containing 10% bile, and all but four when the concentration of bile was 40%. All but one were able to digest human fibrin, although in some instances the digestion was very slow, up to twenty-four hours. One strain produced a low pH (4·5) in glucose broth.

Of the ten *B* strains, two failed to produce a soluble hæmolysin and two others did not split sodium hippurate. All ten strains produced a characteristic orange-brown pigment when grown in tryptic broth (Hartley), and grew on blood agar containing 40% bile.

Of the nine group *C* strains, seven digested human fibrin; four of these were tolerant of as much as 40% of bile in the blood agar plates. One strain fermented sorbite as well as trehalose, and one belonged to the "high acid group"; the final pH in glucose broth being 4·4.

Seven of the eight group *G* strains digested human fibrin. Five were able to grow with 40% of bile and one other with 10% of bile. The final pH in glucose broth did not differ from that observed with the group *A* strains.

The Relationship between the Clinical Condition and the Various Groups.

Of the 64 puerperal strains, 30 were classified as typical members of group *A*, 15 as atypical members of group *A*, 7 as group *B*, 7 as group *C*, and 5 as group *G*.

TABLE V.

Group.	Number of Strains.	Soluble Hæmolysin.	Digestion of Human Fibrin.	Hydrolysis of Sodium Hippurate.	Final pH in Glucose Broth.	Results on Bile Blood Agar Plates.	
						10% Bile.	40% Bile.
Typical Group *A* ..	47	+	+	−	5·3 to 5·6	−	−
	6	+	+	−	5·3 to 5·6	+	−
	13	+	+	−	4·8 to 5·2	−	−
	2	+	+	−	5·0 to 5·2	+	−
	1	+	+	−	5·0	+	+
	1	+	−	−	5·6	−	−
Atypical Group *A* ..	10	+	+	−	4·8 to 5·4	+	+
	3	+	+	−	5·0	+	−
	1	+	+	−	4·5	+	+
	1	+	−	−	5·2	+	−
Group *B*	4	+	−	+	4·3 to 4·5	+	+
	2	+	−	−	4·4	+	+
	2	+	−	+	4·6 to 4·8	+	+
	2	−	−	+	4·6 to 4·8	+	+
Group *C*	2	+	+	−	5·3 to 5·4	+	+
	2	+	+	−	4·8 to 5·2	−	−
	1	+	+	−	5·1	+	−
	2	+	+	−	4·4 to 4·9	+	+
	2	+	−	−	4·8 to 5·0	+	−
Group *G*	4	+	+	−	4·9 to 5·4	+	+
	2	+	+	−	4·9 to 5·4	−	−
	1	+	+	−	5·4	+	−
	1	+	−	−	5·0	+	+

The 49 non-puerperal strains were divided as follows: 40 were typical members of group *A*, 3 belonged to group *B*, 2 to group *C*, 3 to group *G*, and one failed to react with any serum.

A more instructive correlation is obtained by dividing the strains into three series, as follows: (i) strains from fatal cases and from patients who had a rise in temperature above 37·8° C. (100° F.) for more than fourteen days; (ii) strains from patients who had a rise in temperature above 37·8° C. (100° F.) for from seven to fourteen days; (iii) strains from patients who had a rise in temperature above 37·8° C. (100° F.) for less than seven days (see Table VI).

Only four of the typical group *A* strains were from patients with a mild infection, while 42 such strains were associated with fatal or severe disease.

The reverse was the case with the strains classified as atypical members of group *A* and with those belonging to groups *B*, *C* and *G*. Of the 15 strains classed as atypical members of group *A*, all of which were from puerperal fever cases, ten were associated with mild infections and five were from patients who were febrile for from seven to ten days. The clinical condition of these fifteen patients contrasted strongly with that of the 30 puerperal fever patients infected with typical members of group *A*, 21 of whom either died or had a rise of temperature above 37·8° C. (100° F.) for more than fourteen days.

Two *B* strains were associated with severe infections, but in one case a group *A* strain was also present. In the other case, however, a fatal case of endocarditis, the group *B* organism was cultivated alone from the blood on five occasions during life, and from the heart valves after death. Four of the remaining eight *B* strains were from patients who were only mildly ill.

Two of the nine group *C* strains were associated with severe infection in the puerperium, although

TABLE VI.

Strain.	Number of Strains from Fatal Cases and from those in which Temperature was above 37·8° C. (100° F.) for more than Fourteen Days.	Number of Strains from Cases in which Temperature was above 37·8° C. (100° F.) for from Seven to Fourteen Days.	Number of Strains from Cases in which Temperature was above 37·8° C. (100° F.) for less than Seven Days.
Typical Group *A* ..	42 (21 puerperal)	24 (7 puerperal)	4 (2 puerperal)
Atypical Group *A*	0	5 (All puerperal)	10 (All puerperal)
Group *B*	2 (1 puerperal, Group *A* strain also present)	4 (All puerperal)	4 (2 puerperal)
Group *C*	2 (Both puerperal)	2 (1 puerperal)	5 (4 puerperal)
Group *G*	0	1 (Puerperal)	7 (4 puerperal)
Strain failing to react with any serum	0	1	0

in one instance the patient had bronchopneumonia, the infective nature of which was not ascertained. Five of the group *C* strains were from mild infections.

The eight *G* strains appeared even less pathogenic for man than those belonging to the *C* group. No instance of severe infection due to the group was encountered; and in only one instance was the patient febrile for more than one week.

These results may be summarized in another way. Of 46 strains from severe infections, 42 belonged typically to group *A*; of 37 strains from moderately severe infections, 24 belonged to group *A*; while 30 mild cases yielded only four strains which belonged typically to group *A*.

Twenty-four of the strains examined were from blood cultures; of these, 20 were typical members of group *A*, one was classed as an atypical member of group *A*, one belonged to group *B*, one to group *C*, and one to group *G*. The group *B* strain was obtained from the patient with endocarditis already mentioned; the group *C* strain was obtained alone from the blood of a patient severely ill with puerperal fever; the atypical group *A* and the group *G* strains were from cases of septic abortion.

The seven strains isolated from throat cultures were from persons with sore throat or tonsillitis. Three patients yielded typical group *A* strains, one yielded both group *B* and group *G* strains, one yielded group *C* and one yielded group *G*. These last two strains were from nurses who had contracted sore throats while attending patients with puerperal fever infected with streptococci of the same groups.

The two strains cultivated from urine did not belong to group *A*. One was a group *G* strain and the other failed to react with any of the four antisera used.

Summary.

The results are reported of an examination of 113 strains of hæmolytic streptococci isolated in Melbourne from human sources. Both group precipitin and biochemical reactions were studied.

With Lancefield's technique for the group precipitin test 25 strains could not be allotted with certainty to any one group, since seven failed to react with any of the group sera, and 18 gave pronounced cross-reactions. When formamide extracts were prepared from these strains according to the method of Fuller, all but one could be allotted to one or other serological group. It had been noted, however, when the Lancefield tests were being carried out, that most of those strains hydrochloric acid extracts of which reacted with group *A* antiserum and also with one or more of the other sera differed from the strains which had reacted with the group *A* serum alone, in that they grew on 40% ox bile blood agar plates and that in the primary cultures on blood agar plates the colony form was different. Further, these atypical strains were not associated with signs of serious infection. In this paper those strains which belonged to group *A* according to the formamide method, but which gave cross-reactions with Lancefield's method, and which in addition were atypical either as regards tolerance for bile or colony form, have been referred to as atypical members of group *A*.

Of the 113 strains, 70 were typical members of group *A*, 15 were classed as atypical group *A* strains, 10 belonged to group *B*, 9 to group *C*, and 8 to group *G*; one failed to react with any of the four group antisera used.

Although the majority of strains associated with severe infections were typical members of group *A*, a group *B* and a group *C* strain respectively were the only organisms cultivated from the blood of two patients who were gravely ill. Of 46 strains associated with severe infections, 42 were typical members of group *A*; of 37 strains from patients with moderately severe infections, 24 were typical members of group *A*, while 30 mild cases yielded only four such strains.

The clinical condition of the patients with puerperal fever, cultures from whose vaginal swabbings yielded atypical group *A* streptococci, differed from that of the patients infected *post partum* with typical group *A* strains.

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OBSERVATIONS ON DIPHTHERIA AND THE BACTERIAL TYPES OF CORYNEBACTERIUM DIPHTHERIÆ.[1]

By HAROLD WILSON and N. E. GOLDSWORTHY.

(From the Kolling Research Laboratory, Royal North Shore Hospital of Sydney.)

Introduction.

SINCE Anderson, Happold, McLeod and Thompson (1931) described the three types of *Corynebacterium diphtheriæ*, reports have appeared from widely separated countries. Cooper *et alii* (1936) have summarized those from Europe. Others have appeared from the United States of America, by Perry, Whitley and Petran (1936), and from South Africa, by Wright (1937).

The present report is intended to supplement those which have appeared in Australia by Gregory (1936, 1937, 1938), Anderson, Goldsworthy and Ward (1936), Platt (1937) and Puckey (1938).

Material and Methods.

Three hundred and twenty-five persons admitted to the diphtheria wards of the Royal North Shore Hospital from March, 1937, to May, 1938, have been examined clinically, and swabs from the nose or throat have been examined bacteriologically. Swabs have been examined also from eighteen selected patients in whom the disease was malignant (see below) in the Royal Alexandra Hospital for Children or the Prince Henry Hospital.

The disease, during this inquiry, in the Royal North Shore Hospital of Sydney and in Sydney generally was mild (Table I).

[1] This work was carried out under grants from the Commonwealth Government and from the National Health and Medical Research Council.

TABLE I.

Royal North Shore Hospital of Sydney.

(Figures given by the Registrar of the Royal North Shore Hospital of Sydney.)

Year.	Number of Patients with Diphtheria.	Died.	
		Number.	Percentage.
1928[1]	104	7	6·73
1929–30[2]	116	5	4·30
1930–31	163	10	6·13
1931–32	193	1	0·51
1932–33	201	10	4·97
1933–34	247	11	4·45
1934–35	277	11	3·97
1935–36	382	13	3·43
1936–37	273	5	1·83
10 months to 7/5/38 ..	151	2	1·32

[1] Year ended December 31, 1928.
[2] Eighteen months ended June 30, 1930; thenceforward the years end on June 30.

Clinically, faucial diphtheria has been graded as mild, moderately severe or severe, after Bie's (1929) classification, which is summarized in Table II. Laryngeal diphtheria and carriers have been placed in separate groups.

A classification which attempts to indicate the degree of intoxication (the most important feature in faucial diphtheria, although it cannot be measured) must depend on the personal impression of the observer. Malignant diphtheria, in which great intoxication was manifest, was classed as severe; but it will also be discussed separately.

The bacteriological technique of Anderson, Goldsworthy and Ward (1936) was followed, with these exceptions. The amount of potassium tellurite in Clauberg's medium was that recommended by him (Clauberg, 1931). The appearance was observed of broth cultures and of colonies on blood agar plates (10% defibrinated sheep blood, 2·5% agar) and on similar plates made with a basis of Weinberg's peptic digest of liver and beef (Stickell and Meyer, 1918; Turner, 1930). A large loopful of an overnight pure culture on Löffler's medium was used as the inoculum in fermentation tests.

Virulence was determined by subcutaneous injection of a guinea-pig with half the growth on a sixteen-hour Löffler slope culture. Since pure cultures were injected, no control (protected) guinea-pigs were used.

Results.

Bacterial Type in Relation to Severity of the Disease.

In Table III is shown the incidence of the bacterial types among the 200 individuals from

TABLE II.

Grades of Faucial Diphtheria. (After Bie.)

Grade.	Symptoms.				
	Size of Membrane.	Rhinorrhœa.	Fœtor.	Periadenitis.	Toxic Phenomena.
Mild.	Does not cover the tonsil.	Rare.	Rare.	Slight or absent.	Absent.
Moderately severe.	Covers tonsils and part of the palate.	Common.	Common.	As large as hen's egg.	Occasional albuminuria.
Severe.	Surrounds uvula, and covers whole or part of palate or pharyngeal wall.	Common; often profuse.	Common; strong.	Great: patient may be bull-necked.	Pallor, albuminuria *et cetera*.

TABLE III.

The Bacterial Type of 200 Strains in relation to the Grade of Faucial Diphtheria, Laryngeal Diphtheria, Carriers and Deaths.

Bacterial Type.	Severity of Faucial Diphtheria.			Laryngeal.	Carriers.	Total.	Deaths.
	Severe.	Moderately Severe.	Mild.				
Gravis	14	13	65	3	14	109	5
Intermedius	2	3	8	0	0	13	1
Mitis	1	2	28	7	9	47	1
Atypical *Gravis*	0	0	13	0	2	15	0
Atypical *Mitis*	0	2	10	0	4	16	0
Total	17	20	124	10	29	200	7

whom *Corynebacterium diphtheriæ* was isolated. The bacterial types are correlated also with the grade of the disease, with the incidence of laryngeal diphtheria and with carriers and deaths.

There were seven deaths. In two cases death could be ascribed to laryngeal obstruction, in five to intoxication. Of these, four were associated with type *gravis* and one with type *intermedius*.

The number and percentage of patients (carriers excluded) in whom the disease was severe or moderately severe were as follows: of 95 patients infected by type *gravis*, in 17 (17·9%); of 13 infected by type *intermedius*, in 5 (37·1%); of 38 infected by type *mitis*, in 3 (7·8%); of 25 infected by atypical strains, in 2 (8·0%).

Bacterial Type in Relation to Complications and Deaths.

In Table IV is shown the relation between the type of *Corynebacterium diphtheriæ* and complications and deaths, from which it appears that these are associated with type *gravis* more often than with the other types.

TABLE IV.

The Bacterial Type in Faucial Diphtheria in relation to Complications and Deaths.

Bacterial Type.	Number of Patients.	Complications.			Deaths.
		Albuminuria.	Paralysis.	Circulatory Deficiency.	
Gravis	92	19	9	11	4
Intermedius ..	13	0	1	1	1
Mitis	31	3	1	0	0
Atypical *Gravis*	13	1	0	0	0
Atypical *Mitis*	12	0	0	0	0
Total ..	161	23	11	12	5

Bacterial Type in Relation to Antitoxin.

In Table V are shown the average duration of the disease before antitoxin was given and the average dose. Treatment was begun, on an average, about three days after the onset of the disease. Most antitoxin was given to patients infected by type *intermedius*, which suggests that disease due to this type is more severe than that due to the other types.

Bacterial Type in Relation to Malignant Diphtheria.

During the work at the Royal North Shore Hospital throat swabs were examined also from patients with malignant diphtheria in the Royal Alexandra Hospital for Children and the Prince Henry Hospital. There were 18 of these, excluding the five in the main series at the Royal North Shore Hospital. No information is available of the incidence of malignant diphtheria in the Royal Alexandra Hospital for Children or the Prince Henry Hospital. In the Royal North Shore Hospital the disease was malignant in 5 of 172 patients (2·92%). In Table VI are shown the bacterial type, the day of the disease on which antitoxin was given, the dose and the result. Twenty-one of the twenty-three patients were infected by type *gravis*, one was infected by type *intermedius*, and one by an atypical *mitis* strain. Thirteen died (56·5%).

The average interval between the onset of the disease and the giving of antitoxin was 3·3 days.

TABLE V.

The Average Duration of Faucial Diphtheria before Antitoxin was given and the Average Dose.

Bacterial Type.	Severe.			Moderately Severe.			Mild.			All Grades.		
	Number of Patients.	Duration of Illness in Days.	Dose of Antitoxin (Thousands of Units).	Number of Patients.	Duration of Illness in Days.	Dose of Antitoxin (Thousands of Units).	Number of Patients.	Duration of Illness in Days.	Dose of Antitoxin (Thousands of Units).	Number of Patients.	Duration of Illness in Days.	Dose of Antitoxin (Thousands of Units).
Gravis ..	14	3·5	39	13	2·5	33	65	2·9	17	92	3·0	22
Intermedius ..	2	3·0	55	3	2·3	46	8	2·5	21	13	2·5	33
Mitis	1	1·0	30	2	4·0	20	28	3·3	16	31	3·7	19
Atypical *Gravis*	0	—	—	0	—	—	13	2·6	16	13	2·6	16
Atypical *Mitis*	0	—	—	2	4·5	25	10	3·1	16	12	3·1	16
Total ..	17			20			124			161		

TABLE VI.

Malignant Diphtheria: The Bacterial Type, the Day on which Antitoxin was Given, the Dose and the Result.

Hospital.	Patient's Number.	Bacterial Type.	Antitoxin.		Results.	Averages.						
			Day of Disease on which Antitoxin was Administered.	Dose. (Thousands of Units.)		Days of Illness before Administration of Antitoxin.			Thousands of Units of Antitoxin.			Duration of Illness. (Days.)
						All Patients.	Recovered.	Died.	All Patients.	Recovered.	Died.	
Royal Alexandra Hospital for Children.	2	*Gravis.*	2	100	Died, 5th day.	3·3	3·2	3·3	101	90	110	6·4
	3	*Gravis.*	4	100	Died, 4th day.							
	4	*Gravis.*	3	180	Died, 3rd day.							
	5	*Gravis.*	3	100	Recovered after 38 days.							
	7	*Gravis.*	4	140	Recovered after 34 days.							
	8	*Gravis.*	2	250	Recovered after 81 days.							
	9	*Gravis.*	6	200	Died, 9th day.							
	10	*Gravis.*	2	140	Died, 3rd day.							
	11	*Gravis.*	2	220	Died, 5th day.							
Prince Henry Hospital.	1	*Gravis.*	4	131	Died, 13th day.							
	2	*Gravis.*	4	70	Recovered after 63 days.							
	3	*Gravis.*	4	100	Recovered after 51 days.							
	4	*Gravis.*	3	110	Recovered after 30 days.							
	5	*Gravis.*	3	100	Died, 11th day.							
	6	*Gravis.*	4	90	Recovered after 91 days.							
	7	Atypical *Mitis.*	4	70	Recovered after 53 days.							
	8	*Gravis.*	3	86	Died, 13th day.							
	9	*Gravis.*	3	95	Died, 3rd day.							
Royal North Shore Hospital of Sydney.	34	*Gravis.*	1	86	Recovered after 114 days.							
	40	*Intermedius.*	3	55	Died, 3rd day.							
	91	*Gravis.*	3	86	Recovered after 82 days.							
	107	*Gravis.*	4	50	Died, 5th day.							
	169	*Gravis.*	4	50	Died, 6th day.							

This was the same as that in 28 cases at the Royal North Shore Hospital, in which the disease was mild and was due to type *mitis* (Table V). Delay in giving antitoxin, therefore, cannot be held responsible for the malignancy of the disease. The dose of antitoxin and the time which elapsed before it was given are practically the same in the fatal cases as in those in which recovery occurred. This illustrates the inefficacy of even large doses of antitoxin in malignant diphtheria.

Virulence of Atypical Strains.

The virulence of 30 atypical strains was determined: 12 were lethal to guinea-pigs, 18 were not lethal.

Six of the 18 individuals from whom the non-lethal strains were isolated were carriers. In spite of the lack of virulence to the guinea-pig, the remaining 12 persons were suffering from mild sore throat. Of these, however, only three appeared to have diphtheritic membrane.

Of the 12 individuals from whom lethal strains were isolated, the disease was severe in two, moderately severe in three, mild in five, and nasal in two.

Virulence to the guinea-pig cannot, therefore, be correlated with severity of the disease in man; neither can it be correlated with the shape of the colony (see below) nor with fermentation reactions in starch and glycogen.

Discussion.

Criticism of the Technique.

(*a*) *A Comparison of Löffler's and Clauberg's Media.*—The Neisser-stained film from the overnight-mixed culture on Löffler's medium has been correlated with the appearances of the growth on plates of Clauberg's medium incubated for the same time. Of 396 swabs, 213 were "positive" and 126 were "negative" for *Corynebacterium diphtheriæ* on both Löffler's and Clauberg's medium. Eighteen were "positive" on Löffler's medium but "negative" on Clauberg's medium. Thirty-nine were "negative" on Löffler's medium but "positive" on Clauberg's medium; in 25 of these the identity of the organism was confirmed by morphology and fermentation tests, but in 14 the organism was not *Corynebacterium diphtheriæ*.

Bender and Bruns (1936) examined 1,290 swabs from patients in the first two weeks of the disease and found that only a few more were "positive" on Clauberg's medium than on Löffler's medium. In the fourth and fifth weeks, however, they found that Clauberg's medium gave 30% more "positive" cultures than Löffler's medium.

Schmidt (1936) examined 1,018 swabs and found agreement between the results obtained by Clauberg's medium and those obtained by Löffler's medium in 89·7% after twelve hours' incubation and in 95% after thirty-six hours' incubation. Of the remaining 5%, half were "positive" on

Clauberg's medium and "negative" on Löffler's medium, and in the other half the reverse was the case.

Most of our mistakes with Clauberg's medium were made early in the work; after slight experience we made few mistakes. Some of the fourteen colonies wrongly picked were not expected to be colonies of *Corynebacterium diphtheriæ*, but were picked to discover what they were. They were nearly all colonies of diphtheroids, which can be recognized with a little experience. Colonies of cocci are not readily confused with those of *Corynebacterium diphtheriæ*.

There is no means of knowing (but there is some indirect evidence to the contrary), whether the organisms morphologically resembling *Corynebacterium diphtheriæ* which are seen in "positive" smears of the mixed culture on Löffler's medium are *Corynebacterium diphtheriæ*:

(i) Mr. F. Simpson, the senior technician in this laboratory, has isolated diphtheroids, the morphology of which in pure culture could not be confused with that of *Corynebacterium diphtheriæ*. When they were grown in mixed culture, however, they strongly resembled *Corynebacterium diphtheriæ*.

(ii) The growth on some "positive" Löffler cultures has been suspended in broth and plated out on Clauberg's medium without colonies of *Corynebacterium diphtheriæ* being discovered.

(iii) Some Löffler cultures, reported as "positive" by another observer in the routine diagnostic laboratory, have failed to grow colonies of *Corynebacterium diphtheriæ* on Clauberg plates.

It is possible, as Schmidt's results have suggested to us, that there may exist strains of *Corynebacterium diphtheriæ* the growth of which is inhibited in mixed culture on Clauberg's medium. If there are such strains, we think they are quite exceptional. We have isolated no strain which does not grow vigorously in pure culture on this medium.

The ratio (25 : 18) in favour of Clauberg's medium which appears from our figures, would be still more in its favour if it were possible to exclude the false "positives" which we believe to be obtained occasionally on Löffler's medium.

On the other hand, some *gravis* strains of *Corynebacterium diphtheriæ* are sometimes morphologically unrecognizable as *Corynebacterium diphtheriæ* in smears from Löffler cultures, in which they resemble diphtheroids (Parish, 1934, 1936; Murray, 1935). We hope to discuss this in another paper.

Moreover, in the present series of swabs Löffler's medium has been inoculated before Clauberg's medium, and there is therefore a slight advantage to the former. In spite of this, Clauberg's medium has shown more true "positives" than Löffler's medium.

(*b*) *Fermentation Reactions.*—Fermentation reactions, which were tested in peptone water, have been more definite in glycogen than in starch. In this the reaction is often somewhat weak, and usually reverts to alkaline after twenty-four to forty-eight hours, sometimes after eighteen to twenty-four hours. We should not be satisfied to use starch alone. With a large inoculum from an overnight pure Löffler culture heavy growth always occurs in the fermentation media.

(*c*) *Media Used in Classifying Type Intermedius and Atypical Strains.*—Colonies of all types of *Corynebacterium diphtheriæ* are easily recognized after eighteen hours' incubation on Clauberg's medium, even when, as occasionally happens, there is free growth of other organisms.

Typical colonies of types *gravis* and *mitis* conforming to the description of Anderson, Goldsworthy and Ward (1936) can usually be distinguished from one another after eighteen hours' incubation, though it is sometimes necessary to wait till next day; but we have been unable to distinguish with certainty those of type *intermedius*. For this purpose the blood agar media are good; the colonies of type *intermedius* are readily distinguishable at eighteen hours or sooner with the naked eye, by their delicate growth where it is massed and by the smallness of the colonies (0·5 millimetre as compared with the 1·5 millimetres of the *gravis* and *mitis* types) where they are separate. With the colony microscope colonies of type *intermedius* are rough in texture, more or less obtusely conical, and often have a slightly irregular edge. The blood agar media are valuable also to distinguish between colonies of types *gravis* and *mitis* which sometimes cannot be distinguished on Clauberg's medium.

It was the high proportion of atypical strains in our series which led us to introduce blood agar (Weinberg; see above) as a third medium on which to distinguish colonies. It has been useful with some strains, although it is on the whole little better than ordinary blood agar. Of 31 atypical strains, in which the shape of the colonies did not agree with fermentation reactions in starch and glycogen, the colonies were aberrant on Clauberg's medium in 24 strains, on blood agar in 12 strains, and on blood agar Weinberg in 9 strains. We have been, perhaps, too critical in describing as atypical some strains which might have been allowed to pass into one of the three major groups; the colony formation of most of the atypical strains is, however, quite aberrant on one or more media. All atypical strains have been examined repeatedly, but they have not been observed to vary. The colonies of no atypical strain resembled those of type *intermedius*. Atypical fermenters of starch and glycogen are classed as atypical *gravis*, atypical non-fermenters as atypical *mitis*. Fermentation reactions have always been clear-cut.

Growth in broth has generally, but not invariably, been characteristic of the three types. It has, however, been unreliable in our hands in distinguishing between them.

General Remarks.

This report is mainly concerned with diphtheria in an inter-epidemic period, in which the incidence has been low and the disease generally mild (Table II). It was less mild during the inquiry by Anderson, Goldsworthy and Ward (1936) at the Royal

Alexandra Hospital for Children two years ago. In their group of 184 patients, 88, of whom 7 died, were infected by type *mitis*; 96, of whom 25 died, were infected by type *gravis*. They isolated no strains of type *intermedius*. Although there were only 13 cases in our series, we have found disease caused by type *intermedius* to be rather more severe than that caused by type *gravis*, as is suggested by the larger dose of antitoxin given to patients infected by type *intermedius* (Table V). Disease caused by type *mitis* and by atypical strains has been generally mild, although, had there been more patients, we should probably have met some cases of severe disease due to these varieties.

Strains of *Corynebacterium diphtheriæ* isolated from several members of one family or household have always been of one type. Type *gravis* was isolated from nineteen members of seven families; type *intermedius* from two members of one family; type *mitis* from nine members of four families; atypical *gravis* strains were isolated from two members of one family; atypical *mitis* strains from ten members of three families.

Type *gravis* was isolated from eleven patients sent from a holiday home for children who live in remote and separate country districts. Since the incidence of type *gravis* among all strains is 54·5% (Table III), it is probable that that infection came from a common source in the home. One child died.

The high proportion of atypical strains (31 of 200 strains) in an inter-epidemic period accords with the experience of others (Cooper *et alii*, 1936). It would be expected to be lower during an epidemic, in which the strains are apt to belong to one or two predominant types.

Although the relative incidence of *gravis*, *intermedius* and *mitis* infections at the Royal Alexandra Hospital for Children and the Prince Henry Hospital is not known, Table VI serves to show the preponderance of *gravis* infections in malignant diphtheria and the inefficacy of even large doses of antitoxin.

Since Anderson, Goldsworthy and Ward reported the high case mortality among their patients at the Royal Alexandra Hospital for Children (which, however, receives relatively more patients with severe disease than the Prince Henry Hospital or the Royal North Shore Hospital), Schick testing and immunization have become more common. Although the future incidence of diphtheria should therefore be lower, there may be expected, as has been shown by Dudley, May and O'Flynn (1936) a relatively higher proportion of patients with severe disease among susceptible persons who have not yet been immunized.

Summary.

1. Two hundred strains of *Corynebacterium diphtheriæ* have been isolated from 325 individuals at the Royal North Shore Hospital. One hundred and nine patients were infected by type *gravis*, of whom 5 died; 13 were infected by type *intermedius*, of whom 1 died; 47 were infected by type *mitis*, of whom 1 died; and 31 were infected by atypical strains, of whom none died.

2. Twenty-three strains have been isolated from patients with malignant diphtheria in the Royal Alexandra Hospital for Children, the Prince Henry Hospital or the Royal North Shore Hospital. Twenty-one were of type *gravis*, of which 12 were lethal; one was of type *intermedius*, which was lethal; and one was atypical and not lethal.

3. Types *intermedius* and *gravis* caused on the average more severe disease than type *mitis*.

4. The relative merits are discussed of Löffler's and Clauberg's media for the recognition of *Corynebacterium diphtheriæ* and of Clauberg's medium and of two kinds of blood agar for the determination of type.

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Reports of Cases.

HEMIAPLASIA OF THE THYREOID GLAND.

By HUGH R. G. POATE,
Director of Surgery, Prince Henry Hospital; Honorary Consulting Surgeon, Royal Prince Alfred Hospital;
AND
NORMAN WYNDHAM,
Honorary Assistant Surgeon, Royal Prince Alfred Hospital, Sydney.[1]

Incidence.

ABSENCE of one lobe of the thyreoid gland has been recorded on twenty-eight occasions. Pemberton and McCaughan[(2)] have collected twenty-two cases in their survey of the literature on the subject. Sterlin sent a *questionnaire* to goitre surgeons in Switzerland in 1917, and in 7,000 cases hemiaplasia occurred five times. Dubs in 1918 quoted two cases and added two of his own. Ehlers (1886), Weibgen and Dieterle (1911) and Wenglowski (1912) each reported one case; Zuckerman recorded two cases in 1913, and Erdheim reported three cases in 1904. As recently as 1931 Hirschfield contributed three cases to the literature. Pemberton and McCaughan state that the only case reported in English literature is that of Gow,[(1)] in 1883; but C. F. Marshall,[(3)] in an anatomical study of 60 specimens, found one instance of hemiaplasia.

From 1892 to 1932, at the Mayo Clinic, operation was performed 45,367 times for goitre. In five cases hemiaplasia was discovered.

Clinical Histories.

CASE I.—J.K. was a single girl, aged twenty-one years. She was born at Dubbo, New South Wales, where she lived for two years. Since then she had lived in Sydney, for fifteen years at Mosman and for the previous four years at Wentworthville.

There was no family history of any type of goitre; but most members are of an excitable type. The previous medical history of this patient was confined to childish exanthemata. The customary tonsillectomy had been performed.

The patient was quite well until two years before being seen on May 1, 1938. From that time she began to be easily tired, and soon afterwards experienced palpitation on exertion, nervousness, tremulousness and shortness of breath during even mild exercise. Toward evening her ankles were swollen. Apart from infrequent attacks of vomiting, there were no gastrointestinal symptoms. She did not suffer from excess sweating. The hair was becoming thin and fell out abnormally. Loss of weight was hardly noticeable.

Menstruation had become progressively scantier and more irregular.

There had been a noticeable increase in the fullness of the neck for twelve months.

Examination revealed a mild degree of hyperthyreoidism in an otherwise healthy subject. The left lobe of the thyreoid gland was enlarged to about twice its normal size. There was no apparent abnormality on the right side. There was no widening of the palpebral fissure, although the eyes were slightly more prominent than normal. The pulse rate was 88 beats per minute after the patient had settled down in bed in hospital. The systolic blood pressure was 112 and the diastolic pressure 72 millimetres of mercury. There were no signs of important circulatory involvement. The metabolism was not investigated.

FIGURE I.
Photograph of the left lobe of the thyreoid gland in the first case of hemiaplasia.

After two weeks' treatment operation was performed. There was a complete absence of the right lobe of the thyreoid gland. The left lobe was enlarged to about twice its normal size. The surface was smooth. No nodules were felt. There was no thyreoid isthmus or pyramidal vestige.

The lobe weighed twenty grammes. On section it was seen to contain an adenoma. This is seen in the accompanying photograph to comprise about two-thirds of the lobe. Some large colloid-filled vesicles are visible to the naked eye. There is a definite capsule. Microscopic examination of the non-tumour tissue revealed that it was mainly in the colloid-storage phase. The vesicles are moderately large and mostly of the same size. They are well filled with colloid, which stains evenly and well and is not vacuolated. The interlobular and intralobular connective tissue is increased. There are occasional groups of round cells, but no germinal centres. The epithelium is for the most part flat, but here and there cuboidal

[1] The work of one of us (N.W.) on toxic goitre is being sponsored by the National Health and Medical Research Council.

epithelium is seen. The adenoma has the typical general appearance of these structures; but, like so many single adenomata associated with hyperthyreoidism, it shows evidences of great activity. The vesicles are of all sizes and shapes. The epithelium is cuboidal or low columnar. In some places these cells are four or five deep. The colloid stains as deeply as in the non-tumour tissue, but is vacuolated and does not fill the vesicles as well. There are no aggregations of small round cells. The connective tissue is increased. The greatest activity is found immediately beneath the fibrous tissue capsule.

CASE II.—The second case is that of M.H., a female, aged sixty-one years, whose family history was devoid of any thyreoid disturbance and whose previous medical history had been uneventful. She had had goitre for five years, but this was unaccompanied by symptoms until eighteen months prior to examination. At that time she lost a little weight, became nervous, and suffered from fits of mental depression and from occasional palpitation.

On examination she appeared to be in fair physical condition. There was no exophthalmos. A fine digital tremor was apparent, and the resting pulse rate was higher than what could be considered normal, being 120 beats per minute. The thyreoid gland was enlarged on the right side, the swelling appearing to consist mainly of one nodule about three centimetres in diameter.

Operation was performed on June 3, 1938. There was no evidence of a left lobe of the thyreoid gland, either in its normal position or in the posterior triangle of the neck, beneath the sterno-mastoid muscle or in the upper mediastinum. There was no superior thyreoid artery on the left side. (This was the condition on the right side in the previous case.) On the right side in this case there was an adenoma, which occupied the whole of the lobe. This was joined to an isthmus which measured about four millimetres across and two millimetres in thickness. It passed upwards to the region of the hyoid bone. The isthmic tissue was left, but the nodular lobe was removed.

The lobe weighed 29 grammes. It was rounded in shape, being 5·25 centimetres in its greatest diameter and 4·25 centimetres in the shortest diameter. The microscopic appearance was that of an adenoma. The epithelium was extremely hyperplastic. The alveoli were very variable in size and shape. The cells were mainly of low columnar type. In places these were grouped without any alveolus. In parts strands of cells were seen which suggested the structure of a fœtal adenoma. The colloid was very much diminished. There was no increase of connective tissue, except in the surrounding capsule. Small round cells were numerous, sometimes being grouped with a suggestion of germinal centres.

Discussion.

The incidence of this abnormality is small. It is the rarest developmental variation of the gland. It was found only twice by one of us (H.P.) in some 2,000 thyreoidectomies. In the recorded cases the left lobe is usually the one which is absent. Absence of the left lobe occurs twenty times to every three instances of absence of the right lobe. In our two cases the left lobe was absent in one and the right in the other.

The age of the patients from which the material has been taken varies in the literature from a stillborn child to an adult aged eighty-five years. In the majority of instances there has been no abnormality of thyreoid function. In Dieterle's case infantile myxœdema was present. In nine of the recorded cases adenoma associated with hyperthyreoidism was present; in two patients hyperthyreoidism of primary type was the indication for thyreoidectomy; in one instance a simple adenoma existed. In both the cases recorded in this communication adenoma formation and hyperthyreoidism were present.

Stieda, in 1881, suggested that, in addition to the median invagination of pharyngeal endoderm, the fourth branchial cleft contributed elements to the thyreoid gland which finally constituted the greater part of the lobes. Much discussion has since taken place on this point; but the modern view is that the "ultimobranchial bodies" of Grosser, which in the human embryo come from the fifth pouch, do not contribute materially to the thyreoid gland. Hemiaplasia of the gland, according to Zuckerman, is due to failure of development of one of the lateral thyreoid anlagen. In terms of the modern conception, this condition is due to a failure of one of the lobes of the pharyngeal anlage to develop. Normally the thyreoglossal tract between the *foramen cæcum* and the thyreoid isthmus disappears. This had not occurred in one of our cases. In the other there was no evidence of either a pyramidal projection or an isthmus.

The occasional occurrence of this condition makes it essential for the surgeon to determine the existence of the lobe of the opposite side before commencing the removal of part of one lobe.

Summary and Conclusions.

Twenty-three cases of hemiaplasia have appeared in the literature. To these two cases are added. The condition is of rare occurrence.

The existence of hemiaplasia cannot be determined prior to operation. The condition need not be associated with thyreoid dysfunction; and there must be instances in which it is never discovered. No definite figure can, therefore, be given for its incidence.

References.

(1) W. J. Gow: *The Journal of Anatomy and Physiology*, Volume XXXIII, 1883, page 303.
(2) C. F. Marshall: "Variations in the Form of the Thyroid Gland in Man", *The Journal of Anatomy and Physiology*, Volume XXIX, January, 1895.
(3) J. Pemberton and J. McCaughan: "Hemiaplasia of the Thyroid Gland", *Proceedings of the Mayo Foundation*, Volume XXV, 1933, page 517.

Reviews.

ANTENATAL AND POSTNATAL CARE.

THE second edition of "Antenatal and Postnatal Care", by Francis J. Browne, contains new chapters and a considerable amount of fresh matter.[1] The first edition of this admirable book contained an excellent description of the modern methods of antenatal care. The second should prove equally welcome.

Antenatal treatment is discussed from its many angles. The author describes its history and development, and in the succeeding chapters discusses the equipment of the clinic and methods of examination of the patient. Next he treats of the hygiene of pregnancy and the dietary requirements of the mother, laying stress on the necessity for an adequate supply of the so-called protection foods, milk, eggs, fruits and dairy products. All the questions which patients frequently ask concerning food, exercise, vitamins, clothing, bathing *et cetera* are answered. There is a good chapter on the influence of the emotions upon pregnancy, which will assist the obstetrician to allay the fears that beset parturients.

The various methods of determining maturity and postmaturity are given in detail. Under the caption of multiple pregnancy an account is given of the birth of the Dionne quintuplets. The sections on *ante partum* hæmorrhage are particularly good. Discussing *placenta prævia*, the author lays emphasis on the need for early treatment of the mother in hospital, and on the great dangers associated with vaginal packing. The advice given regarding the management of this condition and of accidental hæmorrhage is very sound. Everyone knows that these abnormalities are associated with a high maternal mortality, but if the methods advocated in this book were universally adopted, better results would undoubtedly be obtained. Another good chapter is that on contracted pelvis and

[1] "Antenatal and Postnatal Care", by F. J. Browne, M.D., D.Sc., F.R.C.S., F.C.O.G.; Second Edition; 1937. London: J. and A. Churchill Limited. Large crown 8vo, pp. 606, with 79 illustrations. Price: 18s. net.

disproportion. The advantages and disadvantages of trial labour, induction of premature labour, and Cæsarean section are judicially discussed. The toxæmias of pregnancy are also fully treated.

The various diseases which may be associated with pregnancy, for example, cardiac lesions, anæmia, diabetes and glycosuria and diseases of the ductless glands and of the respiratory and nervous systems, are all clearly described. The treatment of pyelitis by means of alkalis, mandelic acid, "Prontosil", and the ketogenic diet is appropriately discussed. Venereal diseases and the results obtained by the various methods of treatment are mentioned.

Attention is directed to the importance of adequate care in the puerperium and the need for postnatal examinations in order that the patient may remain healthy and well. The value of systematic postnatal exercises from the second day onwards is gradually becoming recognized. Illustrations are given of various exercises. Some of them should be used with caution, for in certain patients they tend to cause a retroversion of the uterus.

OPHTHALMOLOGY.

THE recently published book of Professor Peter C. Kronfeld entitled "An Introduction to Ophthalmology", breaks new ground in the field of ophthalmology.[1] The author might with advantage have given his work the subtitle, "An Essay on Clinical Pathology".

Professor Kronfeld has successfully endeavoured to survey the fundamental principles of ocular pathology in the light of modern knowledge. "The details of diagnosis, of methods of examination and of treatment have been omitted", he writes. "It is thought that they can be more effectively given in the form of oral instruction combined with demonstration *in vivo*. Individual diseases are discussed in this book to illustrate pathogenetic principles."

Although ophthalmology has been called by Clendinnen the "queen of specialities", because he considers it the most accurate and scientific branch of clinical medicine, nevertheless it, more than any other branch of clinical medicine, is prone to become stereotyped by reason of its exactitude. Every ophthalmologist will admit that the great prominence of refractive work in a routine practice and the small amount of pure surgical and medical ophthalmology are the cause of this. A book like this is a tonic to the tired refractionist and gives exhilaration to the weary clinician. In it will be found interesting sections on the rationale of parental therapy, the pathology of phlyctens, the necessity of vitamins, the ætiology of toxic cataracts, the relation of hyperplesia to glycosuric retinitis, the rôle of histamine in chronic glaucoma, the site of metastases of uveal sarcoma, the relation of choked disks to the localization of intracranial tumours and many other topics.

After reading this book many will return to the first page for a further perusal, and if Kronfeld's work is placed in the hands of any man contemplating ophthalmology as his future specialty, it should bring him to a rapid decision.

OBSTETRICS.

PERHAPS no branch of medical science is better supplied with modern and comprehensive text-books than obstetrics, and therefore any new volume must be measured against this standard. Gibberd's "Short Textbook of Midwifery" is such a concise and lucid statement of accepted obstetrical teaching that it should merit a welcome by the student.[2]

The author is well known for his work and critical writings on obstetrical subjects, notably the toxæmias of pregnancy. He has made extensive use of obstetrical experiences at Guy's Hospital, and his chapter on puerperal infections has been influenced particularly by work at Queen Charlotte's Isolation Hospital. Discussing antenatal care, he deprecates the slavish use of unnecessary routine tests at the expense of missing the special needs of the individual patient. In the chapter on the mechanism of labour he quotes the theories of Sellheim, Young, De Snoo and Chassar Moir, the latter's theory of "unequal flexibilities" being held to explain the most important factors. Some of his views are that at birth the baby's head should always be kept on a lower level than the trunk, and the cord doubly ligated and divided as soon as conveniently possible; that for the relief of pain in the first stage of labour chloral and morphine are still the safest and best drugs; and that the practice of autotransfusion to help the patient in a case of ruptured ectopic gestation is slovenly and dangerous.

The section on the toxæmias of pregnancy is excellent, and the subject is not confused by a lengthy statement of conflicting opinions and unproved theories. We notice the addition of two new clinical types of toxæmia—polyneuritis of pregnancy and symmetrical cortical necrosis of the kidney. For primary uterine inertia the author prefers morphine, chloral and paraldehyde (the latter by rectal injection) to the barbiturates as a routine form of treatment. Such oxytocic drugs as pituitrin, quinine, acetylcholine and œstrin are, he asserts, of little service. We do not agree with the author's disapproval of the use of deep catgut sutures for perineal repair, nor is it the consensus of opinion that quinine given in the usual doses for induction of labour causes a fœtal mortality of 5%.

The pleasing feature of the book is the wealth of sound material encompassed in a small volume. The student should find it easy and interesting to read.

SURFACE ANATOMY AND RADIOLOGY.

"SURFACE AND RADIOLOGICAL ANATOMY", by Appleton, Hamilton and Tchaperoff, illustrates the unusual and instructive method of presenting for the information of students and general practitioners the surface landmarks and their relation to the deeper structures by the evidence afforded from radiological investigation of the living subject.[1] This is a vast improvement on the older methods, which are usually based on the dissection of the frozen or hardened cadaver. The book contains views of the living parts in various positions side by side with dissected specimens to show the correspondence of the surface landmarks to the corresponding structures beneath.

Radiological examinations, such as the opaque meal, opaque enema, pyelography and hysterography, are included and related to the surface markings, and such special procedures as gastroscopy, proctoscopy, otoscopy, rhinoscopy and encephalography are similarly treated. A serious blemish is present in the table of ossification. The ages for the female are not separated from those of the male, the authors being content to head the table with the note that "in the female post-natal changes occur approximately one year earlier than in the male". An example of the inaccuracy of this table is the reference to the fusion of the head of the femur, which is stated to occur at the age of eighteen to twenty years. Careful examination shows that in the great majority of cases the femoral head fuses at the age of fourteen in girls and at the age of seventeen in boys. There are similar and more serious discrepancies in other parts of the table. In view of the importance of the study of the epiphyses in the early recognition of endocrine disturbance, this is unfortunate. Nevertheless, the book as a whole is of high value not only to students and general practitioners, but also to radiologists and specialists in other branches.

[1] "Introduction to Ophthalmology", by P. C. Kronfeld, M.D.; 1938. Baltimore: C. C. Thomas. Medium 8vo, pp. 340, with illustrations. Price: $3.50 net.

[2] "A Short Textbook of Midwifery", by G. F. Gibberd, M.B., M.S., F.R.C.S., M.C.O.G.; 1938. London: J. and A. Churchill Limited. Demy 8vo, pp. 536, with 187 illustrations. Price: 15s. net.

[1] "Surface and Radiological Anatomy for Students and General Practitioners", by A. B. Appleton, M.A., M.D., W. J. Hamilton, M.D., B.Ch., D.Sc., F.R.S.E., and I. C. C. Tchaperoff, M.A., M.D., B.Ch., D.M.R.E.; 1938. Cambridge: W. Heffer and Sons Limited. Double crown 9mo, pp. 322, with illustrations, of which many are in colour. Price: 15s. net.

The Medical Journal of Australia

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BLOOD TRANSFUSION.

P. LEVINE AND E. M. KATZIN state that the second International Congress for Blood Transfusion, which was held in Paris in September of last year, gave an impetus to inquiry into the present status of blood transfusion in America.[1] To secure the required information they circulated a *questionnaire*, with the authority of the Blood Transfusion Betterment Association of New York City, among the staffs of all the hospitals approved for internship by the American Medical Association.

One of the most important subjects requiring consideration was the blood group classification. Three different methods of terminology are employed. These are the international (groups *O*, *A*, *B* and *AB*) and those of Jansky (groups I, II, III, IV) and Moss (groups IV, II, III and I). The replies indicate that the Moss numberings are most extensively employed at present. The Jansky and international classifications are used with about equal frequency. The use of the national classification is apparently increasing. Levine and Katzin, however, express disappointment that the majority of the hospitals still use a confusing and arbitrary nomenclature. They point out that the international classification is based upon the universally accepted Landsteiner hypothesis that there are two agglutinable substances, *A* and *B*, in the red cells. When reference is made to the blood group of a universal donor as "group *O*", it is meant that the red cells are inagglutinable by reason of their lack of agglutinable substances. It is also obvious that persons whose blood falls in the groups *A*, *B* and *AB* have the corresponding agglutinable substances in their corpuscles. Levine and Katzin express the hope that existing defects in nomenclature will be remedied at an early date by the teaching of the international classification in the medical schools and by the regulation of donor agencies by the various local boards of health in conjunction with the state or county medical societies. Unfortunately the hospitals associated with most of the American medical schools do not employ the international classification. Levine and Katzin are justified in advocating its universal use. There is now no excuse for the employment of any other.

The possibility of conveying syphilis by means of blood transfusion is of supreme importance. Levine and Katzin made investigations to determine whether a test for syphilis was made in the hospitals just prior to each transfusion. It was ascertained that in 178 hospitals some test for syphilis was performed. In the remaining 172 either there was gross negligence of this precaution or the factor of safety depended on the frequency of routine tests for syphilis undertaken by the organization which supplied the donor. Among the institutions which endeavour to protect the recipients from "transfusion syphilis" by the routine use of pre-

[1] *The Journal of the American Medical Association*, April 16, 1938.

transfusion tests, 53 are supplied with donors whose blood is examined at intervals of six months or less. In 91 hospitals pre-transfusion tests are not done and reliance is placed on a regular serological test made at intervals of six months or less. There is a group of 71 hospitals which are supplied by donor agencies where blood is tested only once or at irregular intervals or at intervals of more than six months, and these hospitals require no test immediately before transfusion. It is obvious that in this group there is a serious possibility of the transmission of syphilis. Both serological tests and careful physical examination should be made.

Discussing the selection of compatible donors, Levine and Katzin affirm that the routine procedure of obtaining a compatible donor by means of a preliminary blood grouping, followed by direct matching of the donor's cells and the recipient's serum, has been firmly established. Five of the hospitals used a blood grouping test alone. This procedure may be safe if the grouping sera remain potent and sterile; but it is generally agreed that direct matching is an additional safeguard which serves as a check on blood grouping tests. It is particularly important, in view of the confusion arising from the numbering in the Moss and Jansky classifications. Further, routine matching is the only known means of detecting the presence in the recipient's serum of atypical agglutinins which may be active against the cells of the contemplated donor. Forty hospitals recorded accidents of various kinds following transfusion.

Levine and Katzin strongly advocate the general adoption of statutes like those of New York and Wisconsin, authorizing courts to accept the results of blood tests in paternity disputes. Recent cables indicate that similar legislation has been suggested and may be shortly enacted in England. Investigating the methods of transfusion, Levine and Katzin observed that about one-half of the hospitals used two methods—the indirect or citrate procedure and one of the direct methods.

De Witt Stettin has also made some observations on this subject.[1] He states that a prospective donor should be of normal weight and have a normal blood pressure, and that his serum should fail to respond to the Wassermann test. Certificates should not be given to any person who has a history or manifests evidence of syphilis or malaria, or who shows any indication of cardiac disease, hyperthyreoidism, asthma, *status lymphaticus*, tuberculosis or other communicable disease, or drug addiction. Although use has hitherto been made of men only, it is intended to have a list of female donors for such special needs as the administration of blood to children or women in religious institutions. The "cutting down" on veins of donors is specifically prohibited, as it is unnecessarily disabling, exposes the donor to infection, destroys his veins and renders him unfit for further service.

Blood transfusion has long since ceased to be a mystical procedure, practised by a privileged few. It is being employed more and more frequently and has become a routine measure in certain conditions. Those who practise it should take pains to make themselves familiar with its every detail.

Current Comment.

SEQUELÆ OF SPINAL ANÆSTHESIA.

SPINAL anæsthesia has now been in general use long enough to have revealed most of its peculiarities. Its present widespread popularity is undoubtedly justified by the excellent results obtained in suitable cases. Since its inception, however, reports have appeared from time to time emphasizing certain dangers and disadvantages of this form of anæsthesia. The unpleasant effects may be classified into two groups. The first includes the early manifestations, which appear during or within about two hours of administration of the anæsthetic, and consist of headache, sudden pain in the back or lower limbs, a fall in blood pressure, collapse, which may be profound, and occasional

[1] *The Journal of the American Medical Association*, April 16, 1938.

respiratory failure. In the second group are the late effects, which appear soon after the operation, and include severe headache and backache, retention of urine followed by incontinence, lack of proper bowel control, weakness or paralysis of muscle groups and impaired visceral and somatic sensation. The fall in blood pressure, the collapse and the respiratory failure which occur in the early stages of spinal anæsthesia are believed to be caused by excessive upward diffusion of the drug, which paralyses efferent vaso-constrictor nerve fibres and may even depress the vital medullary centres. To combat free diffusion of the anæsthetic agent various devices have been tried, such as changing the posture of the patient and using anæsthetics of high or low specific gravity. One manœuvre is the incorporation of a glutinous substance, such as gliadin, in the anæsthetic drug in order to limit its diffusion. "Heavy Duracaine" is a preparation of this type which has been used extensively in some clinics with success as far as the prevention of immediate untoward effects is concerned. However, recent work seems to suggest that this type of spinal anæsthetic is associated with considerable risk of neurological sequelæ.

Fergus R. Ferguson and Kenneth H. Watkins have recently reported fourteen cases of spinal anæsthesia in which the patients developed a *cauda equina* syndrome after the administration of "Heavy Duracaine".[1] Most of the patients were suffering from such an urgent condition as acute appendicitis or perforated duodenal ulcer, but several were undergoing such a simple procedure as herniorrhaphy or cure of bilateral *hallux valgus* and were in good general health. Neurological examination before operation revealed no abnormality in any case. The dose of "Heavy Duracaine" varied from 1·8 cubic centimetres to 2·5 cubic centimetres, and was administered between the third and fourth or the fourth and fifth lumbar spinous processes. No immediate untoward effects were noticed, except in one patient, who collapsed ten minutes after the injection, but recovered quickly and withstood the operation well. The first neurological abnormalities appeared within twenty-four hours of the operation. The disturbances comprising the *cauda equina* syndrome involved the bladder, the bowel, the motor and sensory systems and the reflexes. Complete urinary retention occurred in all patients but one, who suffered from incontinence only. The period of retention varied from one to four weeks and was followed by incontinence, which usually disappeared two or three weeks later, though in two patients it was still present twenty-four months after operation. Minor troubles, such as frequency, precipitancy and dysuria, persisted for many months. The bowel disturbance varied from loss of normal rectal sensation to incontinence of fæces, and lasted from one to six months. Sensory abnormality took the form of numbness in the saddle area, with objective loss of superficial sensation in the region supplied by the third, fourth and fifth sacral segments. In a few cases some sensory loss was still present three years after the operation. Motor disturbances were not prominent, but in nearly all cases the leg muscles showed some weakness, atrophy and fibrillation, which disappeared within three months. The reflexes were affected in all cases, but in varying degree. Thus in some, one ankle jerk was diminished or absent, while in others both knee and ankle jerks disappeared for several months. In one case the ankle jerk was still absent after two years.

Ferguson and Watkins consider that direct trauma, inflammatory reaction and toxicity of the drug are possible explanations of the damage to the *cauda equina*. They conclude that direct trauma is most unlikely to produce any lesion, because no similar disturbance has been reported following simple lumbar puncture. Nor would inflammation explain the findings, because the symptoms appeared so rapidly after the injection. Further, in three patients who came to autopsy, no evidence of inflammatory reaction was found. The authors therefore conclude that the nerve damage is a direct result of the toxicity of the drug. During the period of their observations about 1,200 "Duracaine" spinal anæsthetics were given, so that in this series the *cauda equina* syndrome has the alarming incidence of approximately one in a hundred. In the corresponding period 1,300 spinal anæsthetics were given, the substances used being "Percaine" and "Stovaine", and no case of neurological disturbance resulted.

"Heavy Duracaine" consists of a 10% solution of "Novocain" in 15% ethyl alcohol, with varying amounts of glycerine and gliadin or gum acacia. In an attempt to fix the blame on one of these constituents the investigators carried out a series of experiments on cats. "Heavy Duracaine" injected intrathecally produced a high incidence of paralysis; 15% alcohol and 20% glycerine, without "Novocain", caused no untoward effects; while a 10% solution of "Novocain" by itself was capable of producing *cauda equina* lesions. The incidence of these lesions was increased by the use of stronger solutions of "Novocain". Ferguson and Watkins feel justified in concluding that the toxic agent is the "Novocain". They consider that the danger lies in the fact that full concentrations of the drug remain for some time in contact with nerve roots near the site of injection, on account of the indiffusibility of the mixture. Hence the very property for which this type of spinal anæsthetic was devised, namely, indiffusibility, has proved to be its most hazardous feature.

[1] *The British Journal of Surgery*, April, 1938.

Abstracts from Current Medical Literature.

PHYSIOLOGY.

Blood Volume of Normal Dogs.

JOHN G. GIBSON, JOHN L. KEELEY AND MICHEL PIJOAN (*The American Journal of Physiology*, March, 1938) have determined the plasma volume, cell volume and total blood volume in fifty normal mongrel dogs. The data so obtained have been analysed to determine the normal range of blood volume and to correlate the normal blood volume with body weight, the hæmoglobin content of venous blood and the blood velocity. The plasma volume ranged from 41·2 cubic centimetres to 51·7 cubic centimetres per kilogram of body weight, cell volume from 36·4 cubic centimetres to 54·6 cubic centimetres per kilogram of body weight, and total blood volume from 84·0 cubic centimetres to 97·3 cubic centimetres per kilogram of body weight. No distinct difference in plasma, cell or total blood volume in relation to body weight existed between male and female dogs in this series. The weights of the dogs used varied from five to thirty kilograms. The authors found that with increasing body weight there was an increase in plasma, cell and total blood volume, and an increase in unit plasma, cell and total blood volume expressed in cubic centimetres per kilogram of body weight. Unit cell volume tended to increase more rapidly than unit plasma volume. With increase in body weight and the accompanying increase in total blood volume there were an increase in hæmatocrit and hæmoglobin values, and a slowing of blood velocity. The authors comment that the finding of a definite increase in unit volume with increasing weight is in keeping with what is known of the capacity of various tissues for holding blood. Muscle is blood-rich and fat blood-poor, and it was observed that the weight of the heavier dogs in this series was due largely to muscle, a blood-rich tissue. The authors consider that total blood volume bears a direct relationship chiefly to the amount of muscular tissue in the animal, and state that a similar relationship of total blood volume to the proportion of blood-rich to blood-poor tissue has been found to exist in human beings.

Venous Splenomegaly.

T. BHASKARA MONON (*The Journal of Pathology and Bacteriology*, March, 1938) has made an experimental study of portal congestion, and has attempted to produce proliferative lesions in the spleen. Rabbits and rats were used. Small groups of these animals were subjected to complete and partial obstruction of the portal vein and its branches, either by mechanical means or by the production of periphlebitis and phlebosclerosis. When complete obstruction was present, the animals survived the operation for a period of hours only, and died from mesenteric thrombosis and hæmorrhage into the intestine. The spleen was enlarged to not more than three times its original size, and the histological picture was one of venous infarction, with distension of the capsule and trabeculæ, thinning out of the syncytium, and congestion with blood. The liver was pale and empty in these subjects. In the animals in which partial mechanical obstruction had been produced, which survived for periods up to four months, there was considerable shrinkage of the spleen from the size seen at laparotomy, during the first few days; but engorgement in the subcapsular regions and increase in the trabeculæ still existed. In animals surviving for more than six months there was no increase in size of the spleen. Thickening of the capsule and trabeculæ, some atrophy of the Malpighian bodies, and a general increase in the fibrillary network occurred. The general appearance was one of fibroid atrophy. The liver was little damaged. In the animals surviving portal periphlebitis for six months, capsular and trabecular thickening was found, with little change in the Malpighian bodies; engorgement of the subcapsular sinuses and a diffuse hepatitis in the liver were also present. The author concluded that experimental obstruction of the portal vein in rabbits and rats induced congestion of the splenic veins as long as it was maintained, while narrowing of the lumen induced changes comparable to those following phlebosclerosis in man. There was little resemblance to the splenic anæmia syndrome or to the *fibroadenie* of Banti. The experiments seemed to disprove the belief that the Banti syndrome was due to the blockage of the portal vein.

Interchange of Body Fluids.

J. DOUGLAS ROBERTSON (*The British Journal of Experimental Pathology*, February, 1938) has made a comparison of the interchange of body fluids after the intravenous injection of crystalloids, gum acacia and blood serum. Cats were anæsthetized by "Nembutal", and the normal blood volume was assumed to be 70 cubic centimetres per kilogram of body weight. The variation in blood volume due to the loss of fluid from the vascular system was assessed by hæmoglobin estimations. In all experiments on the intact animal the injection given was 44 cubic centimetres per kilogram, at a rate of four cubic centimetres per kilogram per minute; or in the higher concentrations, a rate of 0·5 cubic centimetre per minute. With strongly hypertonic solutions in small volume the blood volume increased enormously during the injection, considerably in excess of the injected fluid; but equilibrium was rapidly established, and at the end of an hour was normal. With large amounts of hypertonic saline solution a similar effect was obtained; but with isotonic or hypotonic solutions the blood volume increased but slightly and fell slowly. When 6% of gum acacia was added to saline solutions of varying strength, and injected, the effects were the same as that produced by injection of the saline solutions alone; but with a 6% solution of gum acacia in water there was an appreciable increase in blood volume, which was maintained for several hours. When equivalent amounts of gum acacia in 6%, 15% and 33% solutions were given, the two largest volumes produced similar effects. The smallest volume produced a rise and fall less in extent, but maintained for an equal time, which was observed to be ten hours. The author suggests that the mechanism by which these effects are produced is the interchange between the capillaries and the tissue spaces, and the effects produced in an animal which had been subjected to a bilateral nephrectomy were identical with those obtained in the intact animal. After injections of normal cat serum in volumes of 44 cubic centimetres per kilogram of body weight, the blood volume fell, but it was above normal after three hours. Controlled hæmorrhage to the amount of one-fifth of the estimated blood volume was replaced by fluids, so that the theoretical volume at the end of the injection should be unchanged. Records showed that while there was a transfer of fluid from the vessels during the injection, the volume was maintained at a slightly increased level. After infusion with 0·9% sodium chloride solution and blood serum there was a steady fall in blood volume; while with gum acacia there was little fall, whether 6% or 15% solutions were used. The effects could not be ascribed to the gum acacia alone or to the concentration of sodium chloride alone.

The Relation between Blood Osmotic Pressure, Fluid Distribution and Voluntary Water Intake.

ALFRED GILMAN (*The American Journal of Physiology*, October, 1937) describes experiments in which observations on voluntary water intake were correlated with changes in blood osmotic pressure and the general distribution of body fluids. Dogs were used as the laboratory animals. A normal blood sample was taken from the femoral artery, after which the animals received intravenously 2·5 cubic centimetres per kilogram of body weight of either 20% sodium chloride solution or 40% urea solution. These concentrations were approximately isomolar. Thirty minutes were allowed to elapse for the complete equilibration of the substances injected, during which time the dogs were kept quietly on the table and were not given access to

water. At the end of this period a second arterial blood sample was procured and the animals were returned to their cages, where water was available *ad libitum*. Their fluid intake was recorded at fifteen-minute intervals. Blood samples were obtained at intervals during six hours. Measurements were made on the serum of total osmotic pressure by the vapour pressure method of Hill (1930), and of specific gravity by the falling drop method of Barbour and Hamilton (1926). A pronounced increase in the blood osmotic pressure resulted from the injection of hypertonic urea and sodium chloride solutions, but great differences were observed in the specific gravities. The injection of the hypertonic sodium chloride solution was accompanied by a reduction in specific gravity of the serum, whereas no demonstrable change followed the administration of urea solution. The authors consider that the osmotic pressure within the cells of both groups of animals should be the same, despite the difference in fluid distribution. In spite of the identical rise in osmotic pressure, the water intake of these two groups differed considerably. The average voluntary intake, during the first fifteen minutes, of those animals receiving urea solution, was 12 cubic centimetres per kilogram of body weight, whereas during the same period those dogs which had received sodium chloride solution drank 32 cubic centimetres per kilogram. At the end of one hour the average intakes had risen to 20 cubic centimetres per kilogram and 42 cubic centimetres per kilogram respectively. As a result the blood osmotic pressure after the administration of sodium chloride solution returned to its normal level within an hour. After the administration of urea, given in the absence of a thirst stimulus, the osmotic pressure of the blood remained elevated for several hours. The authors deduce from their experiments that the sensation of thirst depends upon more than a mere increase in the total osmotic pressure of the body fluids. After the administration of hypertonic sodium chloride and urea solutions the increases in blood osmotic pressure were the same. The essential difference between the two groups was in the water content of the cell.

Blood Pressure Studies on Infants.

R. A. WOODBURY, M. ROBINOW AND W. F. HAMILTON (*The American Journal of Physiology*, May, 1938) deplore the lack of a standard method of measuring the blood pressure of the new-born. They have obtained records of arterial pressures immediately after birth by means of the "hypodermic manometer" of Hamilton, Brewer and Brotman. The needle of the manometer was inserted directly into an umbilical artery, and the pressure pulses were photographically recorded. The authors state that the same systolic values could be obtained by cuff and palpation if the arm band was 2·5 centimetres wide. The use of the conventional cuff by pædiatricians gave systolic readings too low by 20 to 25 millimetres of mercury.

Alcohol and the Hunger Sense.

C. C. SCOTT, W. W. SCOTT AND A. B. LUCKHARDT (*The American Journal of Physiology*, July, 1938) describe a method of recording the intensity of hunger sensations. Hunger contractions were recorded by the presence of a balloon in the stomach, an alcohol test meal being used. It was found that the hunger contractions, which occurred after the primary inhibitory effect due to the ingested alcohol, produced hunger sensations which were more intense, even slight hunger contractions producing hunger pangs. The effect of similar contractions occurring in a control period was trivial. Alcohol did not increase the amplitude of hunger contractions. In addition, alcohol produced an epigastric sensation during the period of alcohol inhibition preceding the hunger contractions. This feeling was associated with an increased desire for food, but was less intense than hunger and was continuous. It was consequently considered to be appetite.

BIOLOGICAL CHEMISTRY.

Determination of Morphine in Urine of Drug Addicts.

FRED W. OBERST (*The Journal of Biological Chemistry*, May, 1938) has shown that the presence of morphine in the urine of drug addicts may be rapidly determined. If two extractions with ethyl acetate are made, a morphine-molybdate-vanadate complex can be produced by the addition of appropriate reagents. This appears as a fine white precipitate remaining in suspension. The turbidity is roughly proportional to the morphine concentration, and may be compared with a standard. Morphine concentrations as low as 0·03 milligramme in 25 cubic centimetres of urine can be readily detected. Quantitative determinations are made by extraction of morphine from the urine by the Pierce and Plant procedure, followed by acid and alkali extractions. Morphine is removed from the residue by permutit and is finally estimated colorimetrically with the Folin-Denis phenol reagent.

Yellow Marrow in Leucopenias.

C. M. MARBERG AND HAROLD O. WILES (*Archives of Internal Medicine*, March, 1938) deduce from clinical tests that "yellow bone marrow concentrate" contains a substance or substances which stimulate the maturation or liberation of the granular leucocytes. The "concentrate" consisted of the unsaponifiable fraction of the bone marrow. This was given orally to four patients with leucopenia and to six with agranulocytic angina (malignant neutropenia). All the patients recovered. In acute leucopenia, clinical improvement and an increase in the number of leucocytes were observed after forty-eight hours. In no case was there a recurrence of the leucopenia or of the clinical symptoms which accompanied it, during the period of treatment.

Sodium Chloride and Diabetic Pain.

H. R. SANDSTEAD AND A. J. BEAM (*Archives of Internal Medicine*, March, 1938) present observations on ten diabetic patients with neuritic pain and on three with pain of vascular origin. The pain had been in most cases of long duration, and had persisted in spite of treatment for the diabetes. All the patients obtained complete or appreciable relief from the neuritic symptoms after the oral administration of sodium chloride. The relief from pain was accompanied by signs of decrease in the vascular disease in patients with arteriosclerotic pain, and with improvement in the circulation of those with neuritic pain, as shown by the histamine test. The observations indicated that ischæmia, the result of vascular disease, was responsible for the neuritic symptoms. The authors do not offer an explanation for the action of sodium chloride in producing the circulatory changes observed. Chemical studies of the blood indicated no changes after the administration of sodium chloride. Only two patients showed slight œdema of the lower extremities, and no constant change was noted in weight. No evidence was found of impairment of renal function or other ill effect as the result of sodium chloride administration. The authors believe that the administration of sodium chloride is a rational treatment for the neurocirculatory complications of diabetes.

Toxicity of Vitamin A.

EDWARD B. VEDDER AND CHARLES ROSENBERG (*The Journal of Nutrition*, July, 1938) have investigated the alleged toxicity of vitamin *A* by administering it to rats. No toxic effects were observed, unless the dosage exceeded 100,000 international units per day for rats weighing 50 grammes. The greater part of the vitamin *A* administered in such large dosage was destroyed in the body of the rat. Fish liver oils contain in addition to vitamin *A* a toxic principle, at present not identified. The toxicity for rats of various samples of these oils and of their concentrates varied greatly. While vitamin *B* was of no value in counteracting the toxicity of jewfish liver oil, vitamin *D* in proper dosage at least partially counteracted it, and vitamin *C* in doses of five milligrammes per day almost completely counteracted this toxicity.

British Medical Association News.

SCIENTIFIC.

A MEETING of the Victorian Branch of the British Medical Association was held on May 18, 1938, at the Royal Melbourne Hospital. The meeting took the form of a series of clinical demonstrations by members of the honorary medical staff. Parts of this report appeared in the issues of September 3 and September 17, 1938.

Surgical Cases.

DR. J. B. SOMERSET showed several patients of surgical interest. The first was a man, aged forty-seven years, who twelve years earlier had been operated on for repair of a left inguinal hernia. At the same time the left testis was removed. He was told that it was diseased. Five months prior to the meeting he had an attack of severe pain and swelling in the right testis, of sudden onset, lasting six weeks. It was diagnosed at that time as due to torsion of the testis, which had been reduced spontaneously. The right testis had only partially descended. For one month he had had pain of an aching type in the left loin and side. At times it was rather severe and radiated into the groin. He had had similar attacks off and on for the preceding five months, though they were not so severe. Slight frequency of micturition and scalding had been present for the past few weeks. Hæmaturia had never been present. His general health had been poor for six months, and he thought he had lost 6·35 kilograms (one stone) in weight. The appetite was fair and the bowels acted regularly.

When he was examined the patient's temperature was 37·25° C. (99° F.) and the pulse rate was 86 beats to the minute. No evidence of intrathoracic disease was discovered. There was an abdominal scar in the left inguinal region. No rigidity was found and no mass or viscus was palpable. Tenderness was noted in the left loin, both anteriorly and posteriorly, and in the left iliac fossa over the line of the ureter. The left testis was absent. The right testis was in the upper part of the scrotum. It was very tender and flabby and was semiatrophic. A rectal examination was made. The prostate was firm and tender, not enlarged, slightly mobile and smooth. The seminal vesicles were not enlarged.

Examination of a specimen of urine obtained by catheterization revealed numerous calcium oxalate and calcium urate crystals, a few pus cells and a few red blood cells. *Staphylococcus albus* and *Bacillus coli* were grown on culture. X ray examination of the urinary tract revealed no abnormality. Cystoscopy was carried out and revealed a bladder of normal capacity, the mucosa being slightly reddened. Slight general intravesical projection of the prostate was observed. The ureteric orifices were normal and the effluxes were clear. Indigo-carmine, after injection, appeared at the right ureteric orifice in four minutes, and at the left ureteric orifice in eight minutes. The right ureter was catheterized and a specimen was collected. The passage of the catheter was blocked two centimetres from the left ureteric orifice, and even a very small one could not be passed beyond this point. The pyelogram of the right side revealed no abnormality. Examination after injection of "Uroselectan" revealed a normal appearance and function on the right side. Mild hydronephrosis and hydroureter were present on the left, but no definite site of obstruction could be seen. Examination of a twenty-four-hour specimen of urine revealed a blood-stained purulent deposit. Pus cells and red blood cells were present, also non-motile organisms. No tubercle bacilli were found. The right ureteric specimen was sterile; the left contained pus and motile bacilli.

Dr. Somerset's second patient was a man, aged thirty-four years. He had had syphilis seven or eight years earlier, and had been treated in the primary stage. He complained of pain in the back, of a stabbing nature, which had occurred intermittently for four weeks. It came first on the left side, and shortly after moved to the right side. For the preceding two weeks it had been present only on the right side. It sometimes radiated to the side and to the right iliac fossa. It was never very severe, but it had been associated with nausea several times. Scalding and frequency of micturition were severe at the onset, but had diminished. At the time of the meeting he passed urine five to seven times a day and three to four times at night. On several occasions the urine was dark brown in colour. The patient had been having night sweats nearly every night, and had lost over 6·35 kilograms (one stone) in weight since the onset. His appetite was moderately good and the bowels were open regularly.

When he was examined his temperature was 37·8° C. (100° F.) and the pulse rate was 90 beats per minute. The heart and lungs were normal. There was a patch of extreme tenderness in the right loin. The right kidney was easily palpable very low down, and was very tender. Slight tenderness was present in the left loin. The left epididymis was nodular, but the vas was not thickened. Rectal examination revealed no abnormality of the prostate. Specimens of urine collected by catheter were found to contain pus cells; and *Bacillus coli* and *Staphylococcus albus* were grown on culture. X ray examination of the urinary tract revealed that both kidneys were ptosed, the right much more than the left. The kidney shadows were not enlarged. Pyelography, carried out after intravenous injection of "Uroselectan", revealed no abnormality on either side. Cystoscopy revealed no abnormality of the bladder and ureteric orifices, except slight congestion of the bladder mucosa. Indigo-carmine appeared at the right ureteric orifice in six minutes and at the left in four minutes. Ureteric specimens of urine were collected and were both found to be sterile. Further specimens of urine collected by catheter were found to contain *Bacillus coli* and *Staphylococcus albus*.

Ulcers on the Hand.

The last patient shown by Dr. Somerset was a man who twelve years earlier had been bitten on the right hand by a dog. One week later the hand had become septic. It healed in six weeks, but since then the skin had been purplish in colour. Four years later the back of the left hand became purplish in colour, and the patient's nose and ears became covered by scales. He was then treated by a course of gold injections, as the disease was thought to be *lupus erythematosus*, but without much effect.

Two years before the meeting he was treated with radium, as it was believed that his condition was an epithelioma of the hand. Five needles were buried for seven days. About a month later a skin graft was made and the patient was discharged. Four months prior to the meeting he again attended at the out-patient department with a recurrence of the ulcer, which was again diagnosed by the dermatologist as *lupus erythematosus*. Three weeks before the meeting he was referred to the surgical out-patient department, with a view to possible plastic operation.

Mastoidectomy.

DR. JOHN H. SHAW showed a young woman, aged twenty-four years, who had been admitted to the general surgical wards on March 1, 1938, with the history that four hours previously she had been thrown from a horse. Pronounced cerebral irritation and bleeding from the right ear were present, and lumbar puncture revealed grossly blood-stained cerebro-spinal fluid. The patient was discharged to a convalescent hospital ten days later, but returned on the third day complaining of headache and discharge from the left ear. She was rather drowsy, but no abnormality was detected in the cerebro-spinal fluid. The discharge was extremely offensive. There was a pronounced and extensive cellulitis of the scalp in the region of the left mastoid process and some slight neck rigidity was present. A perforation was found in the postero-superior quadrant of the drum membrane, with a pulsating discharge. X ray examination revealed wide opening up of the left parieto-occipital suture. Any attempt at operation on the mastoid was considered too dangerous at this stage. Deep X ray therapy was given on four occasions, in the hope that the infection might be controlled. After the first treatment the temperature

fell and the œdema was much reduced. Ten days later a large fluctuant swelling was localized and was incised, and the margin was stitched back in order to ensure drainage. The patient improved rapidly, and a month later the wound was practically healed, except for a small granulated area. Pronounced tenderness was still present over the mastoid and a certain amount of discharge was coming from the ear.

On April 21 a simple mastoidectomy was performed. The mastoid was cellular and full of pus. The fracture was seen running horizontally across the operative field from the region of the zygomatic cells to the parieto-occipito-mastoid junction. There was much granulation in the line of the fracture and the tegmen was loose and was removed. The dura and lateral sinus were both exposed and found to be healthy. At the time of the meeting the ear was practically healed and the patient's condition was excellent.

Dr. Shaw said that the case was interesting in view of the part played by deep X ray therapy in limiting the spread of infection.

The next patient shown by Dr. Shaw was a boy, aged fifteen years, who had been admitted to the surgical ward on March 21 with a history of recurrent earache in the right ear all his life. There was some deafness in the right ear. The drum was scarred, but no open perforation nor bulging was present. For the previous two weeks he had had severe right earache and neck stiffness; the temperature was 38·35° C. (101° F.), the pulse rate was 64 beats to the minute, and the respiration rate 22 to the minute. A large retropharyngeal bulge was found on the right side of the throat. Some tenderness and fullness were present in the neck under the margin of the sternomastoid. The tip of the mastoid process, however, was quite easily palpable, and there was no swelling in this region. X ray examination revealed no abnormality of the cervical part of the spine, but an opaque right mastoid. The mastoid was not tender on palpation, but there was tenderness over the antrum on deep percussion. Under nitrous oxide and oxygen anæsthesia mastoidectomy was performed on March 25, 1938. An acellular mastoid was found, with a rather small high antrum full of pus. A perisinuous abscess was present; pus flowed with pulsation from a mass of granulation tissue medial to the sinus; pressure on the neck caused a further flow of pus from this point. The sinus was widely exposed for the entire length. The dura was exposed and appeared normal. The wound was packed with bismuth-iodoform-paraffin paste. Subsequent recovery was uneventful. The pharyngeal mass disappeared and the patient's temperature slowly returned to normal during the next four weeks. The child's hearing was subsequently normal.

DR. T. G. MILLAR demonstrated in a prepared specimen the existence and position of the various broncho-pulmonary segments, to draw attention to the importance of the article by J. Hardie Neil, W. Gilmour and F. J. Gwynne, published in THE MEDICAL JOURNAL OF AUSTRALIA of July 31, 1937.

Malignant Disease Treated by Radium and Deep X Ray Therapy.

DR. R. KAYE SCOTT showed a series of patients to illustrate the results of radium and deep X ray therapy.

The first patient was a girl, whose tumour was noted one day after her birth. The child was brought to the hospital when aged three months, with a tumour, about four centimetres in diameter, in the lower left part of the abdominal wall. It was partially excised by the late Dr. Mervyn Stewart, and radium needles were buried in and around the tumour site. Three years later there was a recurrence of the tumour in the tissues below the umbilicus, in which radium needles were buried. The child was well, with a deficiency in the musculature of the abdominal wall, for the next six years. In March, 1936, she fell off a bicycle, the handle-bar of which perforated the abdominal scar, and rupture of the abdomen resulted. This was repaired and the child had been well since, though she still had a weak abdominal scar. At the time of the meeting she was eight years old.

The second patient was a girl, who reported at the age of two and a half years with an infiltrating sarcoma of the lower part of the anterior abdominal wall, eight centimetres by five centimetres in size. It was opened and proved sarcomatous; no intraabdominal mass was found. A radium applicator was applied, but an extensive intramural recurrence appeared fourteen months later. The whole of the abdominal wall from the umbilicus to the pubis and from one anterior superior iliac spine to the other was irradiated with buried needles by Dr. L. J. Clendinnen. Eighteen months later a mass developed below the right nipple, and numerous right axillary glands were found to be enlarged and were also treated with buried radium needles. At the time of the meeting the child was twelve years old and had had no treatment for seven years. She had a weak abdominal scar immediately above the pubis.

Dr. Kaye Scott then showed two patients with carcinoma of the maxillary antrum. The first patient had been treated with buried radium needles by Dr. L. J. Clendinnen, after exploration and biopsy by Dr. Kent Hughes, ten years previously. This patient was well. Skiagrams showed considerable repair of the antral walls with restoration of the antral cavity. The other patient shown had been treated five years previously. The mass had broken through the lateral wall and hard palate. Radium needles were buried extensively into the antrum through the antral wall and into the mass and also through the hard palate. The patient was well. Pneumatization of the antrum and repair of the bony walls were demonstrated in recent films.

Dr. Kaye Scott then showed a patient with secondary metastases in the pelvis from a carcinoma of the breast. Radical excision of the breast had been performed in 1931. Four years later she reported to the hospital with extensive secondary deposits eroding the sacrum and left ilium. There were doubtful areas in the opposite side of the pelvis. Courses of deep X ray therapy had been given at regular intervals during the last three years. The patient had been free of pain since the first course of therapy was given. She had gained 12·7 kilograms (two stone) in weight, and no other secondary deposits had appeared. Recent skiagrams of the pelvis showed repair of the damaged areas and a greatly increased trabeculation throughout the pelvis. Dr. Scott pointed out that the case well demonstrated the wisdom of ordering X ray therapy in all cases of secondary carcinomatosis of bone.

Dr. Scott also showed a man, aged thirty-eight years, who had been treated in 1933 for a nodular tumour of the lower part of the abdomen, approximately the size of a six months' pregnancy. The left testis was present, but imperfectly descended; the right testis was absent from the scrotum and inguinal canal. Investigations revealed no abnormality, and the mass was regarded as a malignant intraabdominal testis. Three courses of deep X ray therapy were given five years prior to the meeting, in 1933, and the mass completely disappeared. The patient was well, abdominal and rectal examination revealing no abnormality. Dr. Scott said that the response to the treatment was held to confirm the diagnosis, as neoplasms of the testis were known to be remarkably radio-sensitive.

Urological Exhibits.

DR. J. THOMSON TAIT showed a series of skiagrams and pathological specimens to illustrate the relationship of aberrant vessels to hydronephrosis, and the diagnosis and treatment of small ureteric stones.

Investigation of a girl, aged eight years, showed that the pelvis of her left kidney was dilated and infected, the pyelogram revealing a stricture at the uretero-pelvic junction. At the operation a band was found containing a rather large artery; and when this was divided the pelvis was seen to contract and empty completely. The kidney was left *in situ* and the patient had shown no symptoms during the following eleven years.

In the second case, that of a woman, aged twenty-six years, the pyelographic appearances suggested a horseshoe kidney, the left renal pelvis being very dilated, while on the right side the calycine system was rotated to turn medially. A vessel crossing the pelvis anteriorly was divided and emptying of the sac took place. The kidney was left and the patient had had no recurrence of symptoms.

The next two patients, aged thirty-seven and fifty-seven years, had had nephrectomy performed, one because when a large vein was divided at operation the lower pole had become swollen and blue, the other because no satisfactory reduction of the pelvic contents occurred after freeing of the obstruction.

During the discussion Dr. Tait invited comments on the following points: (i) That symptoms generally occurred only when an obstructed pelvis became infected; for example, pus cells and *Bacillus coli* were found in the affected kidney in all these cases. (ii) That occurrences at the operation determined whether the kidney could safely be left, two points especially being noted: the emptying or otherwise of the sac by the resumption of normal peristalsis, and the effect on the kidney's circulation of division of the aberrant vessel. (iii) That it was wiser to leave the kidney in the younger patient. In the case of the patient aged fifty-seven years, Dr. Tait felt that, largely on account of his age, nephrectomy was the right procedure.

The X ray films of four patients were shown; in each case the presence of a small stone low in the ureter had been proved. In each the operation of slitting the orifice with scissors through the cystoscope had been carried out; and up to the time of the meeting reports had been received that two of the patients had passed their stones, in one case four days after operation, in the other case after five weeks.

To illustrate the difficulty of proving the presence of a ureteral stone in many patients with typical clinical symptoms, Dr. Tait showed the films of a man, aged thirty years, who had suffered three attacks of renal colic during the preceding two months. Pyelographic and ureterographic examinations were made, and no evidence of a stone could be determined either by an obstruction to the passage of a ureteric catheter, by a filling defect, or by dilatation of the ureter and renal pelvis in any position. It was suggested that in these cases attacks of pain were due to irregular and spasmodic contraction of the musculature. To assist in the diagnosis of such conditions Dr. Tait showed the first cinematograph film produced at the Royal Melbourne Hospital, showing a renal pelvis and ureter, filled with iodide solution, contracting in regular waves under the X ray screen. Some indication of the emptying of calyces, pelvis and ureter under normal stimulus was seen. Dr. Tait expressed the hope that in the future motion pictures of this type would enable departures from the normal to be further studied.

Industrial Disease.

DR. W. W. S. JOHNSTON showed several patients to illustrate aspects of industrial disease.

Lead Poisoning.

The first patient was a man, aged forty-one years, who had been employed as a polisher of lead caskets and had been admitted to hospital, under the care of Dr. C. H. Kellaway, with lead colic. The systolic pressure was 146 and the diastolic pressure 94 millimetres of mercury. There was no enlargement of the heart or thickening of the radial arteries. The fundi were normal. There was no lead line on the gums. Blood examination gave the following results. The hæmoglobin value was 75% (Sahli), the erythrocytes numbered 4,000,000 and the leucocytes 14,500 per cubic millimetre. The colour index was 0·93. Examination of a blood film revealed punctate basophilia affecting 16,000 cells per million, or 1·6%. Reticulocytes numbered 3·5%. No nucleated forms were seen.

The second patient was shown, by courtesy of Dr. R. P. McMeekin, for diagnosis and discussion, with particular reference to the possibility of lead poisoning. He was a man, aged twenty-six years, who had been a painter by occupation and had been admitted to hospital on May 4, 1938, on account of hæmaturia, which had been present intermittently for fourteen days. Twenty-four hours before admission a condition of epididymo-orchitis had supervened. Occipital headaches had been present for the previous five months. Twelve years before the patient had had an attack of pleurisy with effusion, and since then he had had a cough with some greenish coloured sputum, occasionally tinged with blood.

Examination on admission to hospital revealed a temperature of 38·35° C. (101° F.), a blood pressure reading within normal limits, normal fundi and radial arteries. There was a considerable amount of pyorrhœa, and a blue line was present in the lower incisor region. The abdomen was tender in the left lower quadrant. The left epididymis and testicle were swollen and tender, and the prostate, on rectal examination, was also tender.

On May 5, 1938, two attacks of severe abdominal colic occurred. For this 10 cubic centimetres of 15% calcium gluconate solution were injected intravenously with good effect. On May 9, 1938, there was a return of the hæmaturia, and on May 17, 1938, a slight recurrence of abdominal colic.

Further investigations were undertaken, with the following results. The blood urea content was 27 milligrammes per 100 cubic centimetres of blood. Examination of blood films revealed an occasional finely stippled red cell and the presence of polychromatophile cells, but less than 0·05% of the cells were thus affected. Radiological examination of the chest revealed old localized pleural thickening in the right lower zone. No tubercle bacilli were found in the sputum. Radiological examination of the urinary tract revealed no abnormality. A later specimen of urine was found to contain numerous pus cells and motile bacilli, but no red cells or tubercle bacilli. Cystoscopy was attempted with inconclusive results, on account of the tenderness of the prostate gland.

The differential diagnosis was subsequently discussed and the following conditions were considered: lead poisoning, tuberculous and other infections of the genital and urinary tracts, the presence of a calculus or a neoplasm in the urinary tract.

The following aspects of lead poisoning were discussed: (i) the methods of absorption, (ii) the treatment of the acute phases, (iii) the treatment of the more chronic forms, (iv) the diagnosis.

In regard to the methods of absorption, it was pointed out that the respiratory tract was of much greater importance than the alimentary tract, though the possibilities of the latter were almost certainly exemplified by the numerous cases of juvenile Bright's disease in Queensland. The proportion of cases amongst painters had become very much less since the adoption of the practice of supplying painters with paint already mixed with oil instead of in the dry state. At present one of the commonest sources of trouble was the accumulator industry, in which small groups of workers, not having been brought under the *Factories Act*, might account for a number of cases, owing to lack of supervision.

In regard to treatment, it was important in the acute stages to effect storage of the circulating lead in the bones as quickly as possible. This was achieved by making use of the fact that this storage ran parallel with that of calcium. It had been found that the intravenous injection of calcium salts, for example 10 cubic centimetres of 20% calcium gluconate solution, gave quick relief from acute symptoms, such as lead colic. A high calcium diet, consisting of milk, butter, cream and eggs, was helpful in supplementing this immediate treatment, together with the oral administration of 19·5 grammes (30 grains) of calcium lactate three times a day.

When the acute symptoms had subsided, a slow liberation of the stored lead could be instituted. The best means of achieving this was by induction of a condition of acidosis. Ammonium chloride in doses of 9·75 grammes (15 grains), eight times a day, was usually effective. The time-honoured method of administering potassium iodide by mouth, commencing with 0·825 gramme (five

grains), three times a day, was a useful alternative. Care had to be exercised lest at any time the rate of lead excretion rose to a level at which toxic effects ensued. In such an event methods to achieve quick storage had again to be instituted.

In regard to diagnosis, Dr. Johnson referred to such signs as the lead line on the gums, anæmia and stippling of the red cells. Although an important sign, the blue line was not essential for the diagnosis, and in obvious cases of lead poisoning it might fail to appear. The anæmia was usually not of extreme degree, and erythrocyte counts below 3,000,000 per cubic millimetre were rare.

Dr. Johnson said that stippling represented an attempt at regeneration, allied to the production of reticulocytes in the early stage of remission in Addisonian anæmia, the marrow being stimulated to turn out immature red cells to offset the anæmia which resulted from the toxic action of the circulating lead.

Silicosis.

Dr. Johnston then showed a male patient, aged fifty-two years, who had been engaged for fourteen years in gold mining. Six years previously he had attended the Royal Melbourne Hospital for arthritis. At that time he had complained of slight dyspnœa, but on account of the urgency of the joint condition, diagnosis and treatment had been directed mainly to the arthritis. Five years later the patient had been placed under the care of Dr. K. D. Fairley, and his chest was radiologically examined. By then he had begun to suffer from shortness of breath as well as from cough with some mucopurulent expectoration. Radiograms of the chest had shown pronounced silicosis with multiple small discrete nodules.

During the discussion it was pointed out that the danger to be apprehended from various dusts in industry was roughly proportional to the content of silica. It was believed that there was a chemical rather than a mechanical basis for the pathological changes that took place. The particles of silica went into solution, those of smaller size doing so more readily. In this way was explained the greater risk known to arise from the more minute particles, though another fact had also to be taken into consideration, namely, that the finer particles remained suspended in the air longer than the coarser ones. This constituted an important practical problem in industries in which such operations as blasting were concerned. The important association between pulmonary tuberculosis and silicosis was emphasized and a skiagram exemplifying this was shown.

Dr. Johnston said that preventive methods in industry had achieved a high degree of success. Some idea of the extent of this industrial disease could be gained by figures kindly supplied by Dr. D. O. Shiels, Industrial Medical Officer to the Public Health Department of Victoria. In the year 1937 approximately £28,000 and £71,000 respectively had been paid out as compensation in Victoria and Western Australia for preexistent cases as well as those recently diagnosed, whilst in South Africa a sum totalling £11,000,000 had been paid in compensation over a period of eighteen years.

Carbon Monoxide Poisoning.

Dr. Johnston then discussed carbon monoxide poisoning and demonstrated the apparatus used by the Metropolitan Gas Company for immediate treatment. The essential features were a cylinder of "Carbogen", which communicated with a face-piece, the rate of flow being registered by a meter and controlled by both a coarse and a fine adjustment. It was designed to fit into a fibre suitcase, and was thus easily transported. The transient effect resulting from short exposures to coal gas as they occurred in the gas industry was stressed, as also were the difficulties of diagnosing such cases clinically after the immediate effects had worn off.

Radiological Exhibits.

DR. HOWARD F. PRAAGST showed a number of skiagrams of interest, including a series illustrating congenital cystic disease of the lungs. These comprised examples of the solitary cyst, not communicating with a bronchus, and of the multiple small bronchiectatic type of cyst, demonstrated after lipiodol injection. The age of the patients ranged from sixteen to sixty-five years.

Two examples were shown of rupture of the *nucleus pulposus* in the lumbo-sacral region, demonstrated by lipiodol injected by the lumbar route, and confirmed by operation.

Amongst the other conditions illustrated were horseshoe kidney, ureteral calculi of unusual size and appearance, pneumoperitoneum following perforation of the duodenum and transverse colon, bronchogenic carcinoma, metastases in spine and skull from mammary carcinoma, para-œsophageal hernia and congenital short œsophagus.

NOMINATIONS AND ELECTIONS.

THE undermentioned has applied for election as a member of the South Australian Branch of the British Medical Association:

Basedow, Karl Johannes, M.B., B.S., 1938 (Univ. Adelaide), Adelaide Hospital, Adelaide.

Proceedings of the Royal Commission Appointed to Inquire into Matters Pertaining to National Health Insurance.

THE Royal Commission, which had sat last at Sydney on September 9, 1938, resumed sitting at Brisbane on September 13, 1938. Mr. Dovey opened proceedings with a discussion of the nature of the evidence he proposed to put before the Commission in Brisbane.

Mr. Dovey: It is somewhat curious to reflect that throughout the whole of Australia there are almost two thousand medical practitioners who do not belong to the British Medical Association; but despite our appeals from the community generally, so far as I can remember, no medical witness outside the British Medical Association has volunteered to come along, and indeed, I think the only volunteer we have had was a correspondent who communicated with Your Honour and whose letter was handed to the Secretary of the Commission. We shall endeavour to put some such evidence before the Commission. We shall place before the Commission the views of the Council of the Friendly Societies of Queensland on this question and we shall inform the Commission of the situation in respect of friendly society contract practice here. That has already been done in a general way by one witness who spoke for the Insurance Commission; but now that we are on the spot more details are available and they will be given to this Commission.

In passing it is interesting to note that in the city of Brisbane and suburbs there are some 20,000 members of friendly societies and some 110 doctors giving medical service to those 20,000 members and their dependants;

that is according to our instructions. Evidence will be given to the effect that although there are that number of doctors attending those people from year to year, scarcely any complaints have been made on the part of either the medical practitioner or the patient. Naturally, there would be some, but there have been very few indeed.

Other interesting evidence will be placed before the Commission by a representative of the friendly societies in respect of a position which is likely to arise for the dependants of friendly society members who become insured persons. It has been said over and over again by witnesses called by my learned friend that they feared that most of the dependants of friendly society members who become insured persons will be lost to the medical profession; that they will tend to go to hospital for treatment as out-patients. Most of them have said that some proportion of these people would probably seek some form of contract practice. In Queensland, I should imagine, the position is no different from that existing in the other States in this respect. The Commission will be told by one representative of the Friendly Societies' Council, who was also the secretary of a lodge with some 500 members, that the real concern of the members of friendly societies is not the necessity for having to pay 1s. 6d. per week, which will provide other benefits, including medical benefit, but their desire to be satisfied that provision will be made by these organizations for a medical service to be given to the member's wife and dependants. I suggest that that information will be of assistance to the Commission in respect of the first term of reference, and possibly the sixth term of reference. Other matters, which I need not particularize at the moment, will be dealt with by officers of friendly societies.

One very important piece of evidence which we expect to place before the Commission is that which will be given on behalf of an organization known as The Brisbane Associated Friendly Societies' Medical Institute. It is important, because from time to time we have had loud protests from medical practitioners who have not been in England, and very strong statements made by members of the profession who have practised in England as panel practitioners. So far as this inquiry has gone to date, this institute is unique; but we will suggest to the Commission that it approximates, as closely as anything in Australia could do, the English panel practice. It is an organization which is composed of delegates from individual lodges, not from individual societies but from individual lodges, and our instructions are that each lodge in the metropolitan area is represented in it. The capitation rate for friendly societies generally in Queensland is 26s.; it was recently increased from 25s. to 26s., having regard to the index figure on which the 25s. was fixed. But the capitation rate and the capitation fee which is paid in respect of the Friendly Societies' Medical Institute is not 26s., but 22s.; and for that 22s. the member receives medical attention for himself and for his dependants—medical service of a type similar to that given ordinarily to friendly society patients—and, in addition, free hospital treatment, with this qualification so far as hospital treatment is concerned, that he is required to pay 24s. 6d. on admission to hospital. That is calculated at 3s. 6d. a day for seven days, and the Medical Institute has been able for many years to pay its way on considerably less than 22s., and to pass over a substantial sum to the hospital in order to make up the deficiency which otherwise would exist in the hospital's accounts.

The institute has two doctors only, each of whom receives a salary. That salary will be stated *in camera*; but at the moment I can say that the salary is £140 a year more than the salary that was paid to the assistant of the doctor who gave evidence—Dr. Dwyer. In addition to their salary the two doctors have the right to receive fees for excluded services, such as operations *et cetera*, and those excluded services are given for the most part in hospital. They consist of operations and confinements, and the fees are modified fees, compared with the fees payable ordinarily to practitioners in Brisbane. For example, the fee for appendix is seven guineas, including anæsthetic, as against 14 guineas; and for confinements £2 12s. 6d. At the moment I do not remember the other figures, but they will be placed before the Commission.

There are about 20,000 friendly society members in the metropolitan area, and 110 private practitioners looking after them. One very interesting feature about this evidence I suggest is that of those 20,000 members, 4,800 get their medical service through the institute. The secretary of the institute has kept records over a great number of years, and these records, I suggest, will be helpful to the Commission; but, unfortunately, no record has been kept of the number of dependants. However, the secretary made a calculation as well as he could, and he estimated that these 4,800 persons represented approximately 15,000 patients.

Mr. Abrahams: Where did you get that?

Mr. Dovey: That was the best estimate he was able to make; he has no actual records in that respect, but records have been kept of the number of attendances from day to day and from week to week. We find that in the aggregate the two doctors attended between them 42 hours a week at this institute, which has a shop front just like the one which Dr. Sheldon spoke of. They are there for seven hours a day for six days a week, and their hours work out at 42 hours a week. During the year, in round figures, they give 25,000 attendances at the consulting rooms, and I have worked out the attendances very roughly at ten or twelve services per hour. But when one has heard so much about the difficulty of medical men getting through their work, one finds here that a doctor sees at one session as many as 31 patients in an hour. Many of those patients perhaps would require less time than would be required from the insurance doctors, and probably many of them would be "repeat mixture" patients, or would require some service which took very little time indeed. On the same day one finds that the next doctor saw 31 patients in three hours. These figures are all available to the Commission, and they show on the average ten to twelve patients per hour treated. The prescribing of medicines is done in the same way as in the case of any other contract practitioner.

Mr. Abrahams: Do they give any visits in the home?

Mr. Dovey: Yes, and the doctor is not in such a position probably as he would be under the ordinary contract practice. I understand that there is no question of mileage, although I do not pledge myself to that statement. However, instead of the patient communicating with the doctor direct if he wants the doctor at night or on Sunday, and in order to obviate the doctor putting the patient off and saying that he will come around in the morning, the patient rings the secretary of the institute and the latter then communicates with the doctor and tells him that he has got to go out to the patient. This is what happens in practice. During the year the number of visits to the home compared with the number of consultations at the surgery in the ratio of 1 to 10. There is very little conscious misleading of the doctor; but by reason of the fact that these calls go to a layman, probably the doctor is called out more often than would otherwise be the case. Then the doctor has his hours at the hospital, which are comparatively few per week. The hospital has on the average thirteen beds occupied per day, and there is a nursing staff of seven, including the matron and two other fully qualified sisters. Thus a very efficient medical and hospital service is provided by the institute, and so far as the medical service is concerned it more nearly approaches the English panel system than anything we have heard of so far. These figures, I suggest, will be helpful to the Commission. The two doctors I have mentioned have been associated with the institute for twenty years.

Mr. Dovey also stated that evidence would be put before the Commission as to the management of hospitals in Queensland and the manner in which they were financed, making reference to the "Golden Casket".

Argument then arose between Mr. Dovey and Mr. Abrahams as to the foreshadowed criticism of the manner in which Mr. Abrahams had been approaching certain aspects of the inquiry, particularly as to possible loss of private practice.

Mr. Dovey: What we submit is that the method my friend is adopting has the result that the doctors are claiming for recompense for loss of private practice. If that be the result of my friend's case we submit that it is an irrelevant consideration for this Royal Commission. *The National Health and Pensions Insurance Act* is not an Act to indemnify doctors or employ doctors, but is an Act to provide medical services for insured persons. If that be right, we submit that the only question is, what is a fair payment for the services rendered. A number of matters must be taken into consideration under that heading. May I illustrate what I mean? If the Government of any State or of the Commonwealth set up a public clinic in a district, as has been done here, the doctors would not be entitled legally to claim compensation; just as has happened very many times in England and sometimes in Australia, if a deviation is made in a road which has the effect of lessening the value of property in a village or town, the owner has no right to recover from anybody or to have recouped from anybody the loss of capital and the resultant loss of income.

Mr. Abrahams: If that is all that is going to be said, I am perfectly prepared to go on with the evidence. That has been covered by statements already made by the Commission, and I do not propose to say any more about it.

The Chairman: I do not know that it is covered by anything the Commission has said. I do not think that the Commission has directed its mind to it. It is a very big question, which in few words may be stated thus: that in estimating the capitation rate the Commission is to disregard the possible or maybe the certain aggregate loss in money of the medical profession as the result of the insurance scheme being devised.

Mr. Abrahams: We do not ask for any loss to be made up nor for any recompense or immunity from loss. All we say is that the services to be rendered in the future should be judged at the same value as they have been paid for in the past, and that that value is fixed at per service. We can fix it by evidence, and we give the evidence.

The Chairman: We need not discuss the matter further now.

Discussion then took place as to the number of witnesses Mr. Abrahams should call and whether Mr. Dovey intended to call any medical witnesses. Mr. Abrahams endeavoured without success to get a lead from the Commission or Mr. Dovey in this respect. During this discussion the following exchange took place:

The Chairman: What do you say, Mr. Dovey, about calling further witnesses about giving evidence of the same general character.

Mr. Dovey: We do not think that the witnesses that have been called so far are typical of the evidence which might be given throughout Australia.

The Chairman: If you are not prepared to concede anything, Mr. Abrahams must conduct his case in his own way.

Mr. Dovey: We say that much of the evidence that has so far been given is irrelevant; but even if it is relevant, we say that very strong consideration should be given to the weight of such evidence.

Mr. Abrahams: If my friend will not give me a lead I must ask for a short adjournment to consider a certain course of action. My friend says that there are five thousand general practitioners in Australia. Obviously I cannot call them all. I have done my best to put before the Commission the general position in New South Wales, and I propose to do the same in respect of Queensland. Here conditions are somewhat different. For instance, workers' compensation work is of no use to the doctors here at all, because the worker is insured with the Government and pays his own doctor. I propose to call between seventy and a hundred witnesses over the whole of Australia, chosen so as to be a cross-section of the medical profession. It is proposed before we finish to call about twenty-five in Sydney, twenty in Melbourne, and ten in each of the other States other than Tasmania, where the number will be smaller. I expect my friend, who is in charge of the procedure of the Commission, to indicate whether he agrees that that number of witnesses, chosen in that way, will be sufficient. I do not want to be confronted with the position later on that if I call ten witnesses in Queensland I may be asked: "Why did you not call a hundred?"

Mr. Abrahams did not press his application for an adjournment, and later stated that he proposed to call about eight or ten witnesses in Brisbane.

Dr. William John Saxton, Kingaroy, was the first witness. He stated that he was lodge medical officer to four friendly societies and that he had no unnecessary night calls although he did not charge a night fee. He said that the *esprit de corps* among lodge patients deterred them from any abuse of their privileges.

Mr. Abrahams: In Queensland the capitation fee was formerly 30s. per member and 20s. for female members without dependants, but during the depression the fees were reduced to 27s. and 18s. respectively, and in your district they have remained at those figures ever since?

A.: Yes.

Q.: You regard mileage as of greater importance than the capitation rate?

A.: That is the opinion of myself and my colleagues at Kingaroy.

Q.: What mileage do you think should be paid, and how and by whom?

A.: With the present mileage under the lodge agreement at 5s. *plus* the ambulance service, we are not called out. If it were made easier for them to call us out I am afraid they would do so, to their own detriment in the long run, because they would feel that they had a right to do it, and some people like to exert any right they have. We should feel that even in cases where now we can use our own judgement we should be compelled to go because we should be acting as a public servant.

Q.: First, what amount do you consider should be the mileage?

A.: I am afraid that anything less than the present amount would encourage them to call us out.

Q.: Do you think that that should be paid on the same basis as at present, according to the actual mileage in respect to each call, or, as is suggested by the Insurance Commission, at so much for every person on the list?

A.: I think that that is the crucial point. Where it does not affect the patient financially they will make the call, but where they have to pay something each time they call they will avail themselves of the ambulance.

Q.: You think that it ought to be paid at so much a visit?

A.: Yes, most definitely.

Q.: Do you think that the patient should pay it all?

A.: No patient would ever be neglected who could not pay it all. I think that if the patient paid some of it we would be satisfied. We are not anxious for the actual money; we want to keep up our standard of work, and we cannot do it if we have to visit extensively. So long as they paid enough to stop them from calling, that would be all right.

Dr. Saxton was cross-examined by Mr. Dovey. He said that he had previously had a lodge practice at Hamilton, Victoria, and thought that his present lodge patients at Kingaroy represented a more solid section of the community. After cross-examination as to mileage fees he was asked by Mr. Dovey: If you were conceded the right by the Commission to make a charge on the insured person when you are called out unnecessarily, do you think that would be sufficient deterrent?

A.: I think so.

Mr. Dovey: It is plain from the evidence that some further consideration must be given to this question by the Insurance Commission, and I want to get the views of witnesses in order to see whether effect can be given to them. Mr. Brigden has said that he would endeavour to work in harmonious cooperation with the medical practitioners, but under the Act no provision is made in regard to this matter. Mr. Brigden, at page 8 of his statement to the Commission, mentions that the insurance prac-

titioner may be entitled to require and accept payment for certain services, including attendance on a patient outside the surgery when such attendance is unnecessary. That would then become an exclusive service, because the contract requires that the service shall be rendered in the surgery or consulting room, except in cases where the physical condition of the patient prevents him from attending.

After further discussion on this matter the Chairman said: The Commission recognizes that the medical panel practitioner should retain the same sort of protection that he has now. The only thing we have to consider is, what should be the amount which the doctor is entitled to claim against people who make calls of this kind outside the strict terms of the contract. It is quite clear that the Commonwealth Legislature has no power to lay down the particular fee which a doctor may claim in such circumstances, and therefore all the Insurance Commission could do is to say to the doctors to whom it is making a contract: "We require you to agree as to the outside service that you will not charge insured people more than such a rate; otherwise we will not make contract with you." Nevertheless, I believe the only way to give the medical practitioner real protection is to place such services outside the scope of the contracts altogether.

The Commission adjourned at 4.40 p.m. to 10.30 a.m. on Wednesday, September 14, 1938.

Wednesday, September 14, 1938.

When proceedings opened on September 14, 1938, Mr. Dovey corrected his statement that one medical officer at the Institute of Friendly Societies saw 30 odd patients in an hour, stating that this should be 30 odd patients in a session of three hours.

The examination of Dr. Saxton was continued. He estimated that he would lose 30% of his private patients under the national health insurance scheme. He was cross-examined at some length by Mr. Dovey as to the manner in which he arrived at this percentage. Portion of this cross-examination was as follows:

Mr. Dovey: I understood you to say that the 24 prospective insured persons had 54 dependants, and that of those 54 you feared you would lose 35?

A.: That is right.

Q.: Because in those cases the income of the wage-earner was such as to make it unlikely that he would seek medical attention as a private patient, although he does so at present?

A.: If the wage-earner comes under national health insurance he will not have enough left to pay private fees for his dependants.

Q.: Will he not?

A.: I doubt it.

Q.: Because he has to pay 1s. 6d. a week by way of insurance contribution?

A.: If he could do it easily the thought that would occur to him would be, what was the use of the national health insurance scheme. Its object is to help the man who needs it. The other reason is that if national health insurance is run well and proves satisfactory to the wage-earner, I think that he will seek a contract scheme with a friendly society or a hospital contributory scheme for his dependants. If it is well run and is a success he will like it so much that he will say: "I shall see if I cannot do this for the children as well." He cannot get it under national health insurance, so he will look to the hospital contributory scheme or the friendly society.

After further examination on this aspect, the examination of Dr. Saxton was continued *in camera*.

The Commission adjourned until 10.30 a.m. on Thursday, September, 15, 1938.

Thursday, September 15, 1938.

Dr. Reginald James Nash, Wondai, was examined. Wondai is situated on the fringe of the Darling Downs, about 172 miles by road in a north-westerly direction from Brisbane. Dr. Nash gave evidence as to the distances he had to travel and concerning the ambulance service.

Mr. Dovey: There have been references to the ambulance services from practically every doctor examined in Queensland. Since the service is of importance in this State it might be of assistance to the Commission to have an officer called who could explain to the Commission exactly how the ambulance services are conducted.

The Chairman: It may be that the Insurance Commission will find it necessary to institute or to subsidize some such system of conveying patients to the doctor or hospital, instead of requiring the practitioner to go out to see the patients. Of course, in the most distant parts such a service would be impracticable. In those parts, however, the Insurance Commission will probably find that it will have to make special arrangements with the medical practitioners. It will have to deal with them by some special subsidy and not by the capitation fee.

Sir George Mason Allard: Does the State subsidize the ambulance services in Queensland?

A.: Yes.

Q.: Otherwise the money is raised by voluntary contribution, as in the case of the hospitals?

A.: Yes.

Mr. Gain: You know the proposed arrangement of the Insurance Commissioners as to mileage. What do you wish to say about it?

A.: The question of mileage concerns me closely. If I am to be liable to receive calls from any part of the extensive area in which I at present have patients, it will disorganize my practice, particularly that part which has to do with the public hospital. The fact of receiving additional fees for mileage would not help very much. Unless some deterrent is placed on patients to discourage them from calling the doctor unnecessarily without expense to themselves, the number of calls will be increased considerably.

Mr. Gain: The point is, Your Honour, that if the doctor is called away long distances into the country he may have to leave the hospital and other patients without skilled attention.

Dr. Mulvey: That is an important point; and there may also be urgent and acute cases awaiting his attention in the town.

Mr. Gain: The doctor feels if there is a case in the town requiring attention, he may receive a call to attend an insured person in the country, and if he does not answer it he is liable to be disciplined by the insurance authorities.

The Chairman: The insurance system will have to be administered reasonably. No doctor would be required to leave a critically sick patient in order to answer a call in the country. I realize, however, that, particularly where there is only one medical practitioner in a town, it is undesirable that he should be away for any length of time.

Mr. Gain: At present, lodge patients in the outlying districts require you to visit them only on rare occasions?

A.: That is so.

Q.: You know the services that are inside the scope of treatment under national insurance, and you also know the excluded services?

A.: Yes.

Q.: Have you considered the question as to the value per service of the one as against the other?

A.: Yes, and I have found that from both the point of view of the amount of time occupied and the income derived they are about equal per service.

Mr. Dovey: I gather from what you say that the rate to be paid for mileage does not trouble you so much; it is the obligation to travel that you fear?

A.: If one had to make frequent trips it would seriously upset one's practice.

Q.: Do you appreciate that the insured person would be obliged to come to your surgery unless his physical condition prevented him?

The Chairman: That is not in the Act.

Mr. Dovey: Mr. Brigden, who gave evidence on behalf of the Insurance Commission, stated that it was proposed

to bring in regulations to the effect that services shall be rendered between certain hours except in urgent cases; that they shall be rendered in the doctor's consulting rooms except where the physical condition of the patient prevents him from going there. Did you appreciate all that?

A.: Not fully. I did not know of the existence of such regulations.

Mr. Dovey: They have not been made yet, but we have been told that they will be made. Had you known that, your fears would have been allayed?

A.: Not wholly, but to some extent.

Q.: I suppose, if under your contract as a medical practitioner you were given the right to charge a person who called you out unnecessarily, that would get over the difficulty?

A.: Yes.

After examination concerning the hospital accommodation at Wondai, his salary and the number of hours per week that he worked, a figure which he fixed at 75 hours, Dr. Nash was examined *in camera*.

Dr. Henry Arthur Sundstrup, of Townsville, was next examined. Dr. Sundstrup put before the Commission a statement prepared by the Townsville and District Local Association of the Queensland Branch of the British Medical Association, relating to the special circumstances in the north and north-west. The statement began:

> After a careful consideration of the factors in the case the Townsville and District Local Association of the B.M.A. is strongly of the opinion that medical practitioners of north Queensland serving on the Commission's panel are entitled to special consideration as concerning the capitation fee payable by the Commission.
>
> The general grounds of the claim are in respect of the greatly increased costs under which the doctor in north Queensland operates, comprising:
>
> 1. Cost of living.
> 2. Cost of conducting practice—
> (*a*) Cost of car, petrol, drugs and dressings.
> (*b*) Wages of attendants, etc.
> 3. Mileage.
> 4. The remuneration of locum, and his travelling time.
> 5. Post-graduate work.
> 6. Restricted private practice.

After dealing with each of these headings in detail, the statement concluded with the following summary:

> The Commission is charged with the administration of a very large business. It is therefore neither impertinent nor unreasonable to suggest that its method of remuneration to its panel doctors should not ignore ordinary business factors—business factors that are recognized in fact by other competent authorities dealing with the identical question of remuneration.
>
> Neither is it unreasonable to fear that if these factors are ignored the resultant position will be impairment of the service to the Commission's panel patients.
>
> To secure an income compatible with the large capital outlay necessary to qualify and with the personal skill inherent in his work, the panel doctor will, upon the basis of an inadequate capitation fee, be constrained to take an undue number of patients, which, together with the increased amount of clinical work, will deny to the doctor the time necessary to keep himself in touch with progress in the profession, and deny to the patient the time necessary for a full and careful examination of his condition, not to speak of the doctor's personal health, a factor by no means unimportant to the discharge of his duty.
>
> Section 51 of the *National Insurance Act* does not attempt to fix the rate of capitation fee payable to a medical practitioner, and the fact that this matter is left in the discretion of the Commission suggests that Parliament was content that the Commission would set such a fee as would, by taking into consideration all the factors, give to its medical practice a fair and proper remuneration in all the circumstances.
>
> Based upon the foregoing statement—a statement that has been careful to avoid exaggeration—of the position of medical practitioners in north and north-western Queensland, we feel that their claim for a higher capitation fee is amply justified.

Dr. Sunstrup stressed the necessity of a regular change of climate for brain workers in the north, in order to avoid tropical neurasthenia. He stated that it was the habit of doctors in the north to take a post-graduate course in a more bracing climate every two or three years. He was cross-examined by Mr. Dovey on this aspect and on other matters arising out of the statement read to the Commission, and was then examined *in camera*.

Dr. Charles Victor Watson Brown, Longreach, was examined *in camera* and then in open court.

Mr. Abrahams: I think you have made a note as to how many times *per annum* your friendly society members see you?

A.: I have worked that out and find that the males attended four times and the females six times.

Q.: Is there, in your opinion, any reason why, under national health insurance, that average should be raised?

A.: Oh, definitely. I find in my lodge practice that the lodges have a definite prestige to uphold. They do not give us any trouble at all, but as a matter of fact do everything possible to assist us.

Mr. Dovey: How many lodges are there?

A.: Five.

Mr. Abrahams: You say that they have a definite prestige?

A.: In those areas the lodge members consider their lodge as an institution, not as a method of getting medical benefits. To them medical benefits are only a secondary consideration. Since national health insurance is supposed to come in, the number of lodge members last month actually increased, showing that they are looking not for medical benefits but for benefits purely as a social function.

Q.: You think that under national health insurance the people will demand more attention than do lodge members?

A.: Yes.

Q.: It is perfectly obvious that under national health insurance they will demand more than if they had to pay as per visit, like private patients?

A.: Oh, yes.

Dr. Brown then gave detailed evidence in support of his statement that transport costs in his area were greater than elsewhere, owing to increased cost of running repairs, spare parts and petrol, and the extremely bad roads and deterioration due to climatic conditions. He was cross-examined by Mr. Dovey. In reply to Mr. Dovey, Dr. Brown stated that he thought that he should receive one-third more in his area than the standard Australian capitation rate. He agreed with Mr. Dovey that the birth rate in tropical Queensland was higher than in the rest of Queensland and the whole of Australia, and also that the mortality rate was low. Bad debts he estimated at 10%.

Dr. Anthony Joseph Parer, Maleny, which is 63 miles north of Brisbane, was next examined. He stated that he had had experience in panel practice in England, mostly acting as *locum tenens* for short periods. He was at Wandsworth, an industrial and residential area in the south-west of London, for fifteen weeks. After describing the conditions in these panel practices he was asked by Mr. Gain: You have had experience in lodge practice in Australia?

A.: Yes.

Q.: How would you compare the treatment given under lodge practice in Australia to that given under the panel practice in England?

A.: My actual opinion of the panel practice on the other side is that it is not medical attention at all.

Q.: Tell the Commission why you say that?

A.: Well, the number of cases we would see in the time at our disposal was such that there was no attempt at

diagnosis or investigation of the patient's condition. If the patient looked ill, he or she would be immediately sent to the nearest hospital. If there were any investigation needed at all, well, the case was always referred either to the hospital or, if it were a case in which the doctor probably wanted to look at himself, he would ask the patient to come back or wait until the other patients were finished, and he would then give the case perhaps five minutes. There was no attempt at proper diagnosis at all.

Q.: What are the fees?

A.: For private patients, from 2s. 6d. to 3s. 6d. for medicine, 1s. for repeat, and sometimes 1s. 6d.; 1s. 6d. for consultation and 2s. for repeat.

Q.: You used an expression to me about the first aid?

A.: I said the attention given under the panel practice in England would be comparable to first aid attention given, say, in Queensland. That would be about the attention the average panel patient would get in England; it would be comparable to what one would give them in first aid here.

Mr. Abrahams: Amateur first aid?

A.: Say what you would get from a policeman or a railway man or a man holding a first-aid certificate.

Mr. Gain: Did you experience anything about patients expecting to go to hospital?

A.: Yes, if a patient felt really sick and, as frequently happens, you were able to give him a few minutes, you found all he wanted was a certificate *plus* a card to go to hospital and be examined by a Harley Street man, or a real doctor as they called him.

Mr. Dovey: So the picture you put before the Commission is that these medical practitioners with whom you came into contact gave to their patients no better service than could be expected from the policeman or tramway guard who knew something about first aid?

A.: No, I said that in the more settled areas I would not put the service they gave much above ordinary first aid here.

Q.: In short, you say these medical men fell down on their jobs?

A.: Yes.

Q.: They were not doing their jobs properly?

A.: They were doing the best they could in the circumstances.

Q.: They were really taking money under false pretences, because they were not giving medical service at all?

A.: I do not think they were; I am told that it is better than the position which existed before national insurance.

Q.: You seem to regard it as humorous?

A.: No, I think it was a tragedy.

After a lengthy cross-examination by Mr. Dovey concerning the conditions of panel practice in England, of which Dr. Parer gave evidence and during which Dr. Parer stated that he realized that the practices in which he was doing *locum tenens* work were the lowest type of practices, the witness withdrew and the Commission adjourned until Friday, September 16, 1938.

Friday, September 16, 1938.

Dr. Beresford James Butcher, of Eidsvold, 298 miles north-west of Brisbane, was examined. He gave evidence as to the poor roads and difficulties of travel in his district, and was then examined further *in camera*.

Mr. Abrahams raised the question how far members of a family employed on a farm without money payment came under the national health insurance scheme. After discussion, during which it was pointed out that the position was doubtful, it was decided that the Insurance Commission be asked to consider the matter and express their views upon it as soon as possible.

Dr. Horace William Johnson, of Wickham Terrace, Brisbane, was examined. He gave evidence as to the conditions in an English panel practice, with 800 or 900 patients on the panel, in a town about 50 miles north of London, with a population of about 80,000. He stated that he assisted during the winter months, making about 30 calls a day; at the surgery the usual attendances were about 20 in the morning and between 30 and 40 in the evening. He described the equipment at the surgery as meagre, there being no examination couch. He also stated that it took a considerable amount of time to keep the necessary records. Cross-examined by Mr. Dovey, he described the standard of treatment given by the medical practitioner whom he assisted.

Mr. Dovey: Apparently he was a conscientious man and did a good job to his panel patients as well as to his private patients?

A.: I think he was.

Q.: It would not be fair to say he only gave the sort of treatment to be expected from a policeman or a tramcar conductor who had only learned first aid?

A.: He gave more than that.

Q.: He gave the same standard of service as he gave to his private patients?

A.: Yes.

At the conclusion of Dr. Johnson's evidence Mr. Abrahams stated that he had no more evidence to offer at that stage. Witnesses were then called by Mr. Dovey, the first being Walter Ross Gilbert, a public accountant, who devoted part of his time to the secretaryship of the Brisbane Associated Friendly Societies' Medical Institute.

Mr. Gilbert described the constitution of this body, and stated that at June, 1938, 4,758 lodge members contributed to the institute's scheme, the total number of lodge members in Brisbane being about 23,000.

Mr. Dovey: What payments are made by members to this institute and what benefits are given to their members and dependants?

A.: The method of payment is by levy on the lodges, not on individual members, at the rate of 22s. a head for full-rate members, including wives and children, the same as for other lodge services, 11s. for half-rate members—single female members—and 5s. for juveniles.

Q.: Those moneys are paid to the institute by the lodges?

A.: Yes.

Q.: Is it your understanding of the position that the lodges collect from the members the full rate, for example 26s., and pay you the 22s.?

A.: I do not know what the usual practice is. We hope that the benefit will be passed on to the member, to make our proposition a little more attractive.

Q.: For that 22s. what services are given by the institute?

A.: Full doctor services, more or less on the same lines as are covered by the friendly society arrangement, for the man, his wife and children. We also have nurses at the consulting rooms for out-patient work, and a hospital at Victoria Park Road, Kelvin Grove, which members and dependants are entitled to use at low fees.

Q.: What are the fees?

A.: Twenty-four shillings and sixpence for accommodation. There are slight variations. If a member has not been on the list three months he pays 28s., and there are a few private rooms which members are entitled to use for 50s. a week.

Q.: How many beds are there?

A.: Twenty-four.

Q.: What is the average daily number of beds occupied?

A.: During the year ended June 30 last the average of occupied beds was 12·5.

Q.: What nursing staff is provided?

A.: Including the matron, seven nursing and five domestic.

Q.: How many of the seven are fully trained nurses?

A.: Three—the matron and two sisters.

Q.: Is it a training school?

A.: No; there are four assistant nurses.

Q.: Is it a fully equipped hospital?

A.: In every way.

Q.: Has it a surgical theatre?

A.: A fully equipped theatre for all surgical and medical work.

Q.: Are maternity cases taken there?

A.: No.

Q.: Is it subject to the supervision of the Hospitals Board?

A.: Quite.

Q.: At the institute situated in George Street, near Roma Street, provision is made for medical attendance by salaried medical officers?

A.: That is so.

Q.: I understand that there are two medical officers?

A.: At the present time, yes.

Q.: What salary do they receive?

A.: Eight hundred and forty pounds a year.

Q.: In addition to that, have they the right to receive payment for excluded services?

A.: They get all that is paid by the patient in respect of operations, anæsthetics *et cetera*.

Further examined as to the working of the institute, Mr. Gilbert said that night calls went through the secretary, who passed them on to the medical officer on duty, and that the medical officers sometimes complained that they were called out unnecessarily. He also stated that in his opinion there would be an average of two dependants to each fully paid member, but that inquiries were being made from the lodges to get accurate information on this point; this information would be furnished to the Commission when available. The witness supplied figures showing the number of attendances at the consulting room and the number of visits for half-yearly periods over the past five years. For the half-year ending June, 1938, there were 12,084 attendances and 1,270 visits, the daily average attendance at the consulting rooms for the same period being 66.

Mr. Dovey: Do you keep clinical cards for the patients?

A.: Yes, we keep a card for every patient; but it is only an innovation; we have only been doing it for twelve months.

Q.: And the doctor writes his clinical notes on that card?

A.: Yes.

Q.: Is the service that is provided by the medical officer to the patients regarded by the committee of management as satisfactory?

A.: Yes, because we have retained very many of our old members throughout that period, and also the same officers have been there so long. The institution could not exist if the officers were not giving satisfactory service.

Q.: I understand that in the running of this institute you find that on the average you can show a profit of 5s. per member, which you transfer to the credit of the hospital account?

A.: Yes, 5s. 6d. per member, or 25% of the levy, is transferred to the hospital account, and we can still balance our budget; the levy is apportioned—15s. 6d. for medical service and 5s. 6d. for hospital service.

Q.: You still show a profit after transferring that to the hospital account?

A.: Yes.

Mr. Gilbert was cross-examined by Mr. Abrahams on the working of the institute. Questioned as to the reasons for the decline in membership, he ascribed a portion of the decline to the fact that some of the members had become disgruntled and to the fact that the institute could not satisfy everybody. A further reason which he gave was that members who lived five, seven and twelve miles away might prefer to go to general practitioners who were closer.

The Chairman: They have to pay no more to go to a lodge doctor that is closer?

A.: That is so.

After further cross-examination the Commission adjourned until Monday, September 19, 1938.

Correspondence.

THE EXAMINATION OF MEN EXPOSED TO A LEAD HAZARD.

SIR: The ratio of large to small mononuclear cells, investigated by Dr. D. O. Shiels at Mount Isa following the work of Ferguson and Ferguson, appeared to me at the time to be extremely practically useful, both as a help in diagnosis and as a means of evaluating the results of treatment and following the progress of a case. Indeed, this seemed the only laboratory process of value for the latter purpose; the stippled cell count is of little numerical value, and also frequently fails to diminish or even rises as the patient recovers; the lead in urine determination is too cumbersome to be frequently repeated and its clinical application is doubtful.

Determinations were made for me by Dr. Shiels of many confirmed and suspected cases under treatment. A low ratio was found in patients not exposed to the lead hazard; this rose after exposure, but before symptoms developed, and again fell with developing intoxication, or in some cases as a warning, later justified clinically. Recovery was closely accompanied by a rising ratio; when an apparent recovery was not signalled by this sign, my expectation of a relapse was nearly always borne out by events.

I am not qualified to enter into a theoretical hæmatological controversy; but extended empirical confirmation would seem of more value than purely *a priori* theoretical condemnation. Apparently Dr. Windsor-McLean abandoned the method as valueless after observation of only a single case of established plumbism, and a few doubtful ones.

Some other observations of Dr. Windsor-McLean seem to call for comment. In eight years at Mount Isa I encountered few peptic ulcer cases, none of which could be connected with lead poisoning; none of my many plumbism cases presented symptoms suggesting ulcer, except that they were, of course, anæmic in some degree and frequently had some epigastric tenderness, which, however, appeared to me to be due to a myalgia, and similar in character to the so-called arthralgias; the latter, I agree with Dr. Windsor-McLean, are usually extra-articular in origin, and frequently myalgic.

I am surprised that only 37 of 115 men questioned were constipated. Constipation appears as an almost invariable symptom, not of plumbism so much as of the universal purgation with prophylactic intent. Frequently my inquiries on this point were met with an indignant: "Constipated? No! I take a packet of salts every second morning!" Normal bowel action is unusual among the men in consequence, so that this symptom is difficult to evaluate.

Finally, I am puzzled as to the basis for the claim to originality for the observation of polychromasia under the dark ground of films stained apparently in the ordinary way with Sellen's stain. This observation indeed obtrudes itself, especially if Dr. Shiels's advice to wash the slide until faint green is followed. However, my own impression is that many cells that appear merely polychromatic under the ordinary illumination reveal themselves as full of fine stippling under the dark ground.

Yours, etc.,

F. F. PINCUS.

Wickham and Brunswick Streets,
Valley, N.1,
Brisbane.
September 6, 1938.

EXEMPTION FROM TAXATION.

SIR: (1) I gather from a Press report that a medical man applied for exemption of income tax assessment in respect of radio licence fees paid by him, and that his claim was upheld by the court.

(2) Some years ago you published in your columns a list of income tax exemptions to which medical men are entitled, but it did not make mention of radio licence fees.

(3) I, and I fancy many other medical men, would appreciate the publication of a new and up-to-date list of all the exemptions medical men are entitled to claim in making up their income tax returns.

I prefer to remain anonymous. Thanking you in anticipation.

Yours, etc.,

"FIAT JUSTITIA RUAT COELUM."

Obituary.

WILLIAM NATHANIEL ROBERTSON.

WILLIAM NATHANIEL ROBERTSON, who died at Brisbane on June 12, 1938, was born at Edinburgh in 1866. He came to Australia after graduation from the University of Edinburgh in 1893. For a number of years he was engaged in general practice at Ipswich, Queensland, and then in special practice in diseases of the ear, nose and throat at Brisbane. He did more than his share of work as a member of the British Medical Association in the maintenance of the ethical standards of the profession and the organization of the profession in Australia. He was a member of the Federal Council for many years and was one of the original directors of the Australasian Medical Publishing Company, Limited, the proprietors of this journal. For a number of years he was chairman of directors of the company. Perhaps his best work was in the University of Queensland, of which he was for many years vice-chancellor. As a mark of appreciation of his services to the Queensland Branch of the British Medical Association, the members in Queensland have subscribed to a fund that has been offered to the University of Queensland to provide a prize, to be known as the "Dr. William Nathaniel Robertson Medal". This medal is to be awarded annually to the most successful candidate in the final examination for the degrees of Bachelor of Medicine and Bachelor of Surgery in the Faculty of Medicine. The first award will be made in 1940. When the fund accumulates to an amount providing an annual interest of £10 that sum will be awarded in addition as a monetary prize.

Robertson's activities took him all over the Commonwealth, and everywhere he made friends. He will be greatly missed, not only in Queensland, but throughout Australia. He has left a record of achievement that should be a source of inspiration to those who attempt to follow in his footsteps.

The sympathy of the medical profession is extended to Mrs. Robertson and her family in their bereavement.

At a meeting of the Board of Directors of the Australasian Medical Publishing Company, Limited, on August 14, 1938, it was resolved to erect a tablet to the memory of William Nathaniel Robertson at The Printing House, and to place a copy of this obituary notice behind it.

We are indebted to Dr. S. F. McDonald for the following account of Robertson's career.

Like many another Edinburgh student, William Nathaniel Robertson, who died on June 12, 1938, was a son of the manse. His father, Peter Robertson, was a Presbyterian minister, who came to Queensland in 1872. Robertson himself, however, was left behind, at the age of six years, with his grandparents in Edinburgh. There he attended the Royal High School, and later the Medical School in the University of Edinburgh.

From his forbears the boy inherited the Scottish love of work and learning, and acquired the Scottish virtues of generosity and hospitality.

Scots literature was an early and lasting passion, and to the last he would cheer the watchers at his bedside with a phrase from Dean Ramsay or a verse from Burns. He was probably one of the few Australians who could read Blind Harry's "Bruce" with ease and pleasure.

At Edinburgh he made his mark in work and play, and served under the giants who, even after Lister's departure, still filled the chairs in university and college. After his qualification, though pressed by his professor of pathology to remain as his assistant, lack of means prevented his accepting either this or a hospital appointment, and he immediately made his way to Australia. He commenced general practice at Ipswich in 1893. Here he spent six and a half busy and profitable years, acquiring a reputation as a surgeon and obstetrician. He gained, too, a breadth of outlook and a sound basic knowledge of general medicine, which he always declared could be gained only in general practice, and without which a specialist was but half equipped for his job.

In 1899 Dr. H. A. Francis, then conducting a special practice in diseases of the nose and throat in Brisbane, asked Robertson to join him in partnership. At that time the Brisbane public had not learnt to appreciate the value of specialism, and for a young man to leave a promising general practice to risk the unknown as he did was considered remarkable, if not foolhardy. The venture proved successful. Robertson brought to his new field a keenness of insight and a deftness of touch that even then made his work outstanding. He came into his specialty indeed at a time when the field was steadily growing. Much of the older nose and throat work was mere mutilation, but Robertson constantly tried to be corrective rather than destructive, and his reward came soon. He had been to Great Britain and had seen all that could be shown him at that time, and before long he was surpassing many of his teachers. His Scottish keenness and tireless industry, joined to a very dainty skill in operating, took him well into success and he never looked back.

He became nose and throat surgeon to the Hospital for Sick Children (1900-1918) and was soon dealing with tonsils and adenoids in the modern radical fashion, although he was slow to adopt the dissection method of removing tonsils. This was largely because he held that with his skill in using a guillotine he could remove a tonsil as successfully as with knife, scissors and forceps. So he could; but he was exceptional. The ordinary man needs a long and deliberate technique to ensure the removal of all except a few unimportant shreds.

Under Francis's influence he became greatly interested in the treatment of asthma by nasal cauterization, and, despite the scepticism of the younger generation, he continued this treatment to the end of his career, and his results at times confounded his critics.

In 1913 he founded the ear, nose and throat department of the Mater Misericordiæ Public Hospital. He worked there happily till 1926. He was elected an honorary consulting surgeon of the Hospital for Sick Children on his retirement in 1918—no mere empty honour, for he was always ready to come to the aid of his successors on the visiting staff, especially in dealing with foreign bodies in the lung or œsophagus. But to a man of such energy as Robertson, his routine professional work, tremendous though it was, was not enough, and he soon found new worlds to conquer in medical politics and public bodies.

In Ipswich he had taken part in the informal meetings of the Ipswich Medical Society, and on coming to Brisbane he joined the Brisbane Medical Society and helped the movement that combined this body with the British Medical Association in 1905. Although he seldom wrote, he was most regular in attendance at meetings, and was President of the Branch in 1905, a post held again in 1916-1917 and 1935.

In 1901 the Medical Defence Society was formed. He was a foundation member and a councillor of the society till the end. In 1912 was formed the Medical Land Investment Company, which, largely through the efforts of his friend the late Dr. D. A. Cameron, raised sufficient money to build the first home of the Queensland Branch in Adelaide Street. Robertson was an original director of the company and remained so throughout.

He was a director of the Australasian Medical Publishing Company from its inception (1913), and chairman of directors from 1923 till his retirement from the board in 1929.

When the Federal Committee was formed in 1912 he became, with Wilton Love, the first delegate from Queensland—a heavy duty, which he was glad to lay down in 1928.

In 1925 he represented the Australian Branches at the opening of the British Medical Association's new house in Tavistock Square, and presented a presidential chair as a gift from Australia on this occasion. In 1935 the Parent Body recognized his services by electing him a life vice-president for the annual meeting in Melbourne.

After his year as past-president in 1936 he left the Council of the Queensland Branch, and his friends in the profession subscribed the sum of £206 5s., to be handed to the university to endow a medal for the most successful graduating medical student each year. The medal was to be called the Dr. William Nathaniel Robertson Medal, and it is safe to say that of all the honours he received, none gave him greater pleasure.

With the War years from 1914 on, his activities increased. To his intense and lasting regret he was rejected for overseas service; but he made up for it by his tireless work among the camps and hospitals in Brisbane. He had, too, the cause of the ex-soldier very much at heart, and served on the Queensland war committees, where for the work he did he was made a Commander of the British Empire.

Soon after the foundation of the University of Queensland he became a member of the senate. For twelve years he was vice-chancellor. For his university and other public services he received in 1931 the honour of C.M.G.

To Robertson, naturally, the foundation of a medical school was of the greatest interest, and to bring it into being he spent much of his time during his later years at committee work, writing, speaking and studying. He had always insisted on a high standard for the university; but for the medical school he became even more scrupulous, working long hours and arguing with those who sometimes did not see eye to eye with him. If the standard of teaching in Queensland be comparable with that of older centres, much of the credit will go to Robertson. No more inspiring figure could its students find than their own vice-chancellor, starting (in his own words) as a "minister's penniless son" to become finally the head of his profession and the vice-chancellor of their university.

His own university was not forgetful, and in March of this year he received word that the senatus expected him to attend on July 20 to receive the degree of Doctor of Laws. *The Scotsman* of May 13, 1938, publishes his name with a dozen others.

In 1926 was founded the Australasian College of Surgeons, now the Royal Australasian College, and Robertson was one of the founders. At the birth of the college many bitter things were said. In Robertson's case at least there was no thought of self-interest nor anything but the honour and credit of his branch of the medical profession. Later he yas elected a fellow of the American college, a very gratifying honour.

Naturally a man with his wide range of interests could not escape membership of several other bodies. Among others he was a director and later chairman of the Queensland Board of the Australian Mutual Provident Society and a trustee of the Queensland Art Gallery.

One activity from small beginnings produced great effects. As a member of the Rotary Club he called the club's attention to the problem of the crippled child, bringing to its notice a helpless child in a collier's cottage at Ipswich. The idea was keenly taken up by the club, and the fruit is the Queensland Society for Crippled Children, with its active organization and its fine home and school at Montrose, Corinda.

But among all these activities, which tend to degenerate into a mere catalogue, there remains the image of the man himself. Deeply interested in his work, passionately concerned with his patients' welfare, he will be gratefully remembered by hundreds, not least so by members of his own profession and their families. To them not only his skill and knowledge were always available, but his friendship and hospitality. Was a colleague's child to have tonsils removed, then the mother must rest in his flat at "Craigston"; was the wife of a country doctor in hospital, then the husband must be taken to lunch or dinner to meet some other men who might interest him. Was a friend having a stormy convalescence after an operation, he was in the hospital at midnight and at six next morning in dressing-gown and slippers to see how things were. Did someone need a change after treatment, a seaside home was on offer at once; while, after he had given up hospital work, all his old friends knew that they had only to send along a deserving case and the patient received every care with no thought of fees.

No doubt people often imposed upon him; but patients' comments in the past few weeks have shown that there was some very real gratitude; and obviously many of those at his funeral were people whom he had befriended.

With children he was especially happy. Although so much he had to do to them hurt and frightened, he always tried (and not unsuccessfully) to gain their confidence and affection.

His deftness in operation was matched by his skill as a cabinet-maker, and for years the President of the Queensland Branch has occupied at council meetings a special chair made in his carpenter's shop.

Add that he was an enthusiastic boating, fishing and shooting sportsman, a reader with wide tastes (perhaps most for travel and biography), and the picture is filled in. He never forgot his Scottish origin, and even a hint of Doric in a visitor's speech would set him off on a ramble in Scottish tale and proverb. And how those expatriated Scots would love it!

No better summing up could one give of his character than the words written by another Scot fifty years ago: "Generosity he has, such as is possible to those who practise an art, never to those who drive a trade, discretion tested by a thousand secrets, and what are more important, Heraclean cheerfulness and courage."

Dr. J. Lockhart Gibson writes:

The death of William Nathaniel Robertson leaves a great blank in Brisbane and in Queensland. It is difficult for those who knew him well to realize that his engaging, virile, energetic, kindly and cheerful personality has gone from our midst. The widespread regret in all classes of the community is an object lesson.

He will be missed, and much missed, by many sections of the community. His profession showed its appreciation by thrice electing him President of the Queensland Branch, and by creating a memorial prize to him at the university.

At the great meeting of the British Medical Association in Melbourne in 1935 he had the honour of being elected a vice-president of the Parent Association. He was for many years a member of the Federal Committee of the British Medical Association Branches, and its vice-chairman. At the university his energetic and tactful work as vice-chancellor and in taking a prominent part in the foundation of the new medical school will be remembered always.

In the last issue of *The Edinburgh University Journal*, just to hand, I find in the list of those to whom the senatus had "resolved to offer Honorary Degree of Doctor of Laws", the name of "William Nathaniel Robertson, C.B.E., C.M.G., M.B., C.M., Vice-Chancellor of the University of Queensland".

In addition to his high reputation in his profession, he gained also a high one for his financial acumen. It was probably more for this than even for his medical qualities that he was made chairman in Queensland of the Australian Mutual Provident Society.

He was a very faithful friend and proved this abundantly to his many friends and relatives. His medical colleagues owed much to him for friendship, for his medical help and skill to them personally and to their patients. His generosity to those patients unable to pay upheld the highest traditions of our profession.

He gave many years of honorary medical service to the Hospital for Sick Children and to the Mater Hospital.

His home life was all that his best friends could wish. To his widow and their sons and daughters our heartfelt sympathy is extended.

His medical son Arnold bids fair to follow in his father's footsteps. This thought was an increasing delight to him.

Dr. D. Gifford Croll writes:

"Give me a man who sings at his work", says Carlyle; and such a man was William Nathaniel Robertson. Cheerfulness was his outstanding characteristic, and he probably had more friends in every class of the community than any other man in Queensland. His character was well

described by one who said: "He has about him that ruggedness which becomes a man". A dour fighter when necessary, he nevertheless fought with a smile, and no one could be more generous to a defeated adversary. To enumerate all of his multiple activities for the welfare of the community is not my province here, nor would it be possible to do so in any short space.

For a generation he has been a leader of the British Medical Association in Queensland, and only last year he laid down his position on the council, which he had held without a break for thirty-five years. During that period he had been four times President of the Branch. In every movement for the advancement of the medical profession he took a leading part, and last year, in recognition of his services, the members subscribed to establish the William Nathaniel Robertson Medal and Prize in the Medical School of the University of Queensland, for the most successful candidate in the final examinations. For many years he represented the Queensland Branch on the Federal Committee of the British Medical Association, of which he was vice-president, and by his firmness and tact he was largely instrumental in bringing to finality the formation of the Federal Council of the British Medical Association in Australia. He was a director, and for some years chairman of directors, of the Australasian Medical Publishing Company, Limited, and in this capacity laid the foundation stone of The Printing House. He was chairman of directors of the Queensland Medical Land and Investment Company, which erected the B.M.A. Building in Adelaide Street, Brisbane, from where the Association has recently transferred its quarters to B.M.A. House in Wickham Terrace. He was a director of the British Medical Agency of Queensland, and a foundation member and past-president of the Queensland Medical Defence Society, founded in 1901. He was a foundation member of the Royal Australasian College of Surgeons.

Of his professional work I should especially like to speak, because that perhaps is not so widely known as his public activities. It was his greatest pride that he spent a number of years in strenuous general practice before undertaking a speciality; and as a specialist he always held to the true general practitioner view that his patient was a fellow being and not just a "case". It was this trait which made him such a valued consultant, both to the family doctor and the patient. His work was always of the highest quality. A wonderful man with his hands, he could carry out easily and successfully operations which others would approach with grave misgivings.

No one was quicker to adopt new ideas which he thought were good, and yet he could be obstinately conservative in regard to popular ideas which he thought were unsound, and the passage of years and changing medical fashions so often proved that he was right. His opinions were firmly held; but he never attempted to justify or defend them. The most he would ever say was: "Well, that is my opinion, but whatever is best for the patient will do for me." For many years he was honorary surgeon for ear, nose and throat at the Hospital for Sick Children and the Mater Misericordiæ Hospital, Brisbane.

Intensely loyal to the Empire, he devoted all of his energies to the advancement of Australia; but his work was recognized and honoured in Great Britain and America.

Mourned on every hand in Queensland, he will ever be remembered by the medical men as a great leader and a grand friend.

Sir Henry Newland writes:

In common with all those who served on the Federal Committee of the British Medical Association in Australia, I treasure the memories of the happy meetings. Robertson's sanity of outlook and sense of proportion made him a wise counsellor. Let it not be thought, however, that a persistent gravity was a characteristic of his. A gay quip in his sonorous voice, to the accompaniment of a hearty laugh, would often brighten the proceedings. It was with much reluctance that he retired from the Federal Committee, but warnings that he must foster his strength compelled the step.

He had a great fund of good Scottish stories, and this led to his often being called to play the part of raconteur on the many occasions on which the Federal Committee was entertained in Sydney and Melbourne. Collecting antique furniture was one of his hobbies, and he loved to pick up a good piece.

Hailing from Scotland, it is not surprising that he was intensely interested in higher education, and, as Vice-Chancellor of the University of Queensland, he performed work of the greatest value to a young institution. Robertson was yet another example of the debt the Empire owes to Scotland.

Dr. F. S. Hone writes:

Some men lay foundations; others build the superstructure. Alike by the circumstances of his time and by his personal gifts, Robertson, of Brisbane, belonged to the former class. And on his part these foundations were well and truly laid. His colleagues in Brisbane will doubtless tell of his efforts for the profession there, and of his labours as Vice-Chancellor of the University of Queensland, to lay the foundations of the Queensland Medical School, and of his multifarious activities for the public good. His colleagues in another State may be permitted to pay their tribute to his services for the medical profession in Australia. And apart from those personal qualities which endeared him to so wide a circle of friends, it is perhaps fitting as we set out on a new stage in the journey of our profession to dwell a little on the deeds of those who twenty-five years ago laid the foundations of our present medical organization.

It was in 1911, after he had established himself in Brisbane as a nose, ear and throat surgeon, that Robertson came to the Australasian Medical Congress held that year in Sydney, and made his first acquaintance with Australian medical politics. When in humorous vein in later years, he used to say jocularly: "Men have told me how they learned this and learned that at the Sydney congress, but I learned how to charge!"

That Sydney congress was memorable in more ways than one. The full discussion of congress on venereal disease led to the passage of those resolutions of congress which were the basis of the Australian legislation for the control of venereal disease that was passed a few years later in all the States.

Another full discussion on the proposal of the late Dr. W. T. Hayward for the formation of a permanent medical association for Australia led to the formation of the Federal Committee, which held its first meeting in Melbourne in May, 1912, and continued to function with increasing vigour until it was replaced by the present Federal Council. Queensland was fortunate—and so was Australia—in that its first two delegates were Wilton Love and W. N. Robertson. Both were thoughtful men with wise judgement, and both were genial personalities, with a fund of after-dinner stories, so that they quickly became popular with the men from the other States. When Wilton Love retired from the Federal Committee, W. N. Robertson became one of its leaders, till on the elevation of Sir George Syme to the chairmanship, he became the vice-chairman.

But his greatest influence was probably in connexion with that early offspring of the Federal Committee—the Australasian Medical Publishing Company. He was one of the first directors. In this position his wide vision, combined with his inborn Scotch canniness, his cheery faith and optimism, and his friendliness and gift for friendship, made him a unifying force and a power for progress. At the beginning he held out strongly for giving the company the widest powers, instead of limiting its function, as some desired, to the publication of the journal, and this policy has been amply justified by its results in recent years. He early formed a close personal friendship with the first editor, the late Dr. W. H. Armit, and during all those unexpected difficulties from rising prices of paper, loss of advertisements, and general dislocation of the profession and of business that occurred in the years of the War, Armit turned more and more to him for advice and support, and always found him a loyal

supporter and faithful friend, never afraid to speak his mind when he differed in policy, but always backing him against the timorous and doubting. Those half-yearly meetings became a delight to the men who shared in them, and as the years went by Robertson became known and appreciated throughout Australia by an ever-increasing circle of friends. They appreciated his professional knowledge and keenness; they admired his high standard of ethics; they learnt to trust his judgement and rely on his unselfish leadership: they revelled in his jokes and stories, and they cherished his quiet and abiding friendship. Not many know that in 1924, after a Federal Committee meeting in Melbourne, he journeyed unsolicited and unexpected to Adelaide because he thought his special professional knowledge might help a colleague's wife who had been suddenly stricken with illness. But such acts of friendship and unselfishness were characteristic of him, and the medical profession and the public of Australia owe much to his life and are the poorer for his passing.

Dr. T. W. Lipscomb writes:

The passing of William Nathaniel Robertson leaves a very big gap in the medical community of Australia, and New Zealand too. We in other States knew what a tower of strength he was in all matters medical in Queensland, and the enormous amount of time he devoted in an honorary capacity to further professional knowledge and the profession.

Robertson was one of the original directors of this company, and its chairman from 1920 to 1929, and then only relinquished the chair because he considered a director from this State, in which The Printing House is situated, should occupy that position.

He laid the foundation stone of The Printing House in Seamer Street, Glebe, and we who follow on see much evidence of his guiding hand in the principles of the business that he and his co-directors had initiated.

An ever-welcome attendant at board meetings, at Federal Committee meetings and at meetings of congress, he was an outstanding personality. I know no man who was more approachable when any doctor, young or not so young, went to him for advice. He would enter into the subject most thoroughly, and his many years of experience made his advice most helpful.

"Robbie", as he was called, was a veritable prince of raconteurs, and with a fund of anecdotes given with his north-of-the-Tweed accent, he was most welcome at convivial gatherings when the day's deliberations were over.

Would that there were more stalwarts of the profession coming on such as he.

Dr. Robert Godsall writes:

With the passing of William Nathaniel Robertson we have lost one of the founders of modern ear, nose and throat work in Australia. His early training in general surgery gave him an operative command that at once established him as a leader in our work.

"Robbie" was a big man in every way, physically and mentally. Endowed with a robust constitution, he performed prodigies of operative work, and this, combined with a high degree of manual dexterity, placed him in the foremost rank. After a heavy day's work he would retire to his workshop, where he showed himself to be a cabinet-maker of great ability. Socially he was a charming host, and on visits to the northern capital his friends were overwhelmed by his hospitality; he was an excellent story-teller, with a delightful wit, and his tales, told with a Scotch burr, took on an added piquancy. His energy was inexhaustible; he covered every field of medicine and surgery, and his work on the Federal Committee and the University of Queensland are shining stars in Australian medicine and surgery. Hatred of sham and misleading reports of cases made him a valuable and forceful speaker in debates.

One could write many pages on "Robbie", with his gruff exterior masking a very sweet and simple personality. In conclusion I feel that the quotation of a brother Scot, R. L. Stevenson, aptly summarizes his life:

> . . . most serene and genial by disposition; full of racy words and quaint thoughts. Laughter attended on his coming. He had the air of a great gentleman, jovial and royal with his equals, and to the poorest student gentle and attentive.
>
> Power seemed to reside in him exhaustless; we saw him stoop to play with us, but held him marked for higher destinies.
>
> So he walked among us, both hands full of gifts, carrying with nonchalance the seeds of a most influential life . . .
>
> Well, now he is out of the fight: the burden that he bore thrown down before the great deliverer.
>
> Before those who loved him his memory shines like a reproach, they honour him for silent lessons; they cherish his example; and in what remains before them of their toil, fear to be unworthy of the dead.
>
> We "in the vast cathedral leave him
> God accept him
> Christ receive him."

Proceedings of the Australian Medical Boards.

SOUTH AUSTRALIA.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Practitioners Act*, 1919, of South Australia, as duly qualified medical practitioners:

Benjamin, Philip Joseph, M.B., B.S., 1930, M.D., 1935 (Univ. Melbourne), Renmark.
Baumatz, Szaja, M.D., 1926 (Siena), Adelaide.

QUEENSLAND.

THE undermentioned have been registered, pursuant to the provisions of *The Medical Acts*, 1925 *to* 1935, of Queensland, as duly qualified medical practitioners:

Arnheim, Felicitas, M.D., 1937 (Siena), Brisbane.
Hansen, Anna Lydia, M.B., Ch.B., 1931 (Univ. New Zealand), Brisbane.
Prichard, Robert John, M.R.C.S. (England), L.R.C.P. (London), 1899, Murwillumbah.

TASMANIA.

THE undermentioned has been registered, pursuant to the provisions of the *Medical Act*, 1918, of Tasmania, as a duly qualified medical practitioner:

McNaughton, Alan Herbert, M.B., B.S., 1932 (Univ. Melbourne), Launceston.

Corrigenda.

DR. EWEN DOWNIE has submitted a number of corrections that he wishes to be made to his paper, "Some Observations on the Use of Protamine Zinc Insulin in the Management of Diabetes Mellitus", which was published in the issue of this journal dated September 10, 1938. Owing to a clerical error the proofs of Dr. Downie's paper were wrongly addressed and the author had no opportunity of reading them. We apologize to Dr. Downie for any inconvenience that this error has caused him. A list of corrections, supplied by Dr. Downie, is published below.

At page 421, in the sixth line of the second paragraph, for "experience" read "show". At page 422, in the ninth line of the left-hand column, for "use" read "dose"; in the right-hand column, in the fourth line of the fourth para-

graph, delete "now"; in the seventh line of the seventh paragraph, before "unsatisfactory" insert "definitely". At page 423, in the tenth line, "some definite" should read "some very definite". At page 424, in the left-hand column, the tenth line of the seventh paragraph, for "satisfactorily controlled" read "satisfactory"; in the right-hand column, the first line of the second paragraph, omit "was" and "who". At page 425, in the left-hand column, the sixth line of the third paragraph, for "Freedom from sugar" read "Sugarfreedom" (*sic*); in the thirteenth line of the fifth paragraph, for "signs" read "symptoms"; in the right-hand column, the fourth line of the second paragraph, for "pronounced" read "marked"; for the sixth line of the second paragraph, read "a time and then began suddenly to develop hypoglycæmia"; in the fifteenth line of the same paragraph, for "sugar" read "sugar values"; in the third and fourth lines of the sixth paragraph, for "the diabetic undergoing surgical procedures" read "the surgical diabetic patient". At page 426, for the first two lines read "that by the early injection of large doses of protamine zinc insulin in the treatment of coma, there is a rapid and" . . .

DR. MAX MICHEL has drawn our attention to a typographical error in his letter on "Toxic Goitre, with Special Reference to End-Results", which appeared in the issue of September 17, 1938. In the penultimate line of the fifth paragraph "1%" should read "1‰".

Diary for the Month.

SEPT. 27.—New South Wales Branch, B.M.A.: Medical Politics Committee.
SEPT. 28.—Victorian Branch, B.M.A.: Council.
SEPT. 29.—South Australian Branch, B.M.A.: Branch.
SEPT. 29.—New South Wales Branch, B.M.A.: Branch.
SEPT. 30.—New South Wales Branch, B.M.A.: Annual Meeting of Delegates.
OCT. 4.—New South Wales Branch, B.M.A.: Council (Quarterly).
OCT. 5.—Western Australian Branch, B.M.A.: Council.
OCT. 5.—Victorian Branch, B.M.A.: Branch.
OCT. 6.—South Australian Branch, B.M.A.: Council.
OCT. 7.—Queensland Branch, B.M.A.: Branch.
OCT. 11.—New South Wales Branch, B.M.A.: Organization and Science Committee.
OCT. 11.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
OCT. 14.—Queensland Branch, B.M.A.: Council.
OCT. 18.—New South Wales Branch, B.M.A.: Ethics Committee.
OCT. 19.—Western Australian Branch, B.M.A.: Branch.
OCT. 20.—New South Wales Branch, B.M.A.: Clinical Meeting.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser", pages xx to xxii.

ANTI-TUBERCULOSIS ASSOCIATION OF NEW SOUTH WALES: Honorary Radiographer.
BALMAIN AND DISTRICT HOSPITAL, BALMAIN, NEW SOUTH WALES: Ear, Nose and Throat Surgeon.
BUNDABERG HOSPITALS BOARD, BUNDABERG, QUEENSLAND: Resident Medical Officer.
CHILDREN'S HOSPITAL (INCORPORATED), PERTH, WESTERN AUSTRALIA: Junior Resident Medical Officers.
FREMANTLE HOSPITAL, FREMANTLE, WESTERN AUSTRALIA: Junior Resident Medical Officer.
ROYAL HOBART HOSPITAL, HOBART, TASMANIA: Resident Medical Officer.
THE BROKEN HILL AND DISTRICT HOSPITAL, BROKEN HILL, NEW SOUTH WALES: Resident Medical Officer.
THE PRINCE HENRY HOSPITAL, SYDNEY, NEW SOUTH WALES: Fellow in Anæsthesia.
TOOWOOMBA HOSPITALS BOARD, TOOWOOMBA, QUEENSLAND: Senior Resident Medical Officer.
VICTORIAN EYE AND EAR HOSPITAL, MELBOURNE, VICTORIA: Staff Vacancies.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCHES.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17.	Brisbane Associate Friendly Societies' Medical Institute. Proserpine District Hospital. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.
SOUTH AUSTRALIAN: Secretary, 178, North Terrace, Adelaide.	All Lodge appointments in South Australia. All contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.

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